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THE CONTEXT OF INSTRUCTIONAL TELEVISION. SUMMARY REPORT OF RESEARCH FINDINGS, THE DENVER-STANFORD PROJECT.

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DENVER PUBLIC SCHOOLS, COLO.

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EFFECTIVE MEANS OF TEACHING SPANISH IN ELEMENTARY SCHOOLS OF DENVER, COLORADO, WERE STUDIED. EFFORTS WERE DIRECTED TOWARD DETERMINING THE KIND OF LEARNING AND LEARNING CONTEXT THAT WOULD MAKE FOR MAXIMUM LEARNING FROM INSTRUCTIONAL TELEVISION. PROJECT DURATION WAS FROM 1960 TO THE BEGINNING OF 1964. THE PURPOSE OF THE PROJECT WAS TO SYSTEMATICALLY VARY THE ELEMENTS IN THE LEARNING SITUATION, TEST DIFFERENT TREATMENTS AND COMBINATIONS, AND IDENTIFY THE MOST EFFECTIVE COMBINATIONS FOR DIFFERENT SITUATIONS. TEACHERS WERE ASSIGNED AT RANDOM TO DIFFERENT EXPERIMENTAL CONDITIONS SO THAT AN ENTIRE CLASS WOULD HAVE THE SAME TREATMENT. CONTEXTS FOR INSTRUCTIONAL TELEVISION WERE DISCUSSED AND WERE PRESENTED FOR BOTH THE FIFTH AND SIXTH GRADE. OTHER REPORTS IN THE DENVER-STANFORD PROJECT ARE ED 003 244 THROUGH ED 003 247. (JC)

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THE CONTEXT OF INSTRUCTIONAL TELEVISION--- SUMMARY REPORT OF RESEARCH FINDINGS

1960-1964

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Denver Public Schools • Stanford University

RESEARCH ON THE CONTEXT OF INSTRUCTIONAL TELEVISION

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THE CONTEXT OF INSTRUCTIONAL TELEVISION -- Part 5

Summary Report of Research Findings

The Denver-Stanford Project

Title VII Project Number 354

National Defense Education Act of 1958

Grant Number 7-14-1380-083

Wilbur Schramm, Kenneth E. Oberholtzer, principal investigators .

Richard F. Carter . John L. Hayman, Jr. . Roy A. Hinderman .

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Denver, Colorado and Stanford, California

June, 1964

This is a report of research conducted collaboratively by the Denver Public Schools and the Institute for Communication Research, of Stanford University. Kenneth E. Oberholtzer served as principal investigator for the Denver Public Schools, and Wilbur Schramm for Stanford. John L. Hayman, Jr., was project director for Stanford, and James T. Johnson, Jr., for Denver. Among many other persons who played important parts in planning and carrying out the project we must mention at least Roy A. Hinderman and Lloid B. Jones, of Denver, and Richard F. Carter and Alan E. Mayers, of Stanford. However, without the intelligent and helpful cooperation of dozens of other administrators, supervisors, and consultants, hundreds of teachers, and thousands of parents and pupils, the project could not have been carried out. To all these friends and aiders, we are grateful.

We have tried to write the report so that someone other than a trained researcher can read it. Many of the tables and other details a research scholar will want are in the appendix, and reference is made to a number of them in the text. Still more details are available in the separate reports of the project (see the Bibliography of Project Reports). But the main text of this report is intended not to frighten away a school administrator, teacher, school board member, or layman who is interested in the problem of using instructional television, or of teaching foreign language in the elementary school.

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1. THE PROBLEM AND THE RESEARCH ON IT

There is no longer any serious doubt that pupils learn efficiently from instructional television. Yet television seldom stands alone as a learning experience in the classroom. The classroom teacher typically builds around it a skein of related learning experiences -- drill, explanation, reading, and so forth. Therefore, having proved by several hundred experiments that children learn from instructional television standing alone, we now find it necessary to ask a further question: What combinations of related activities with television make for most efficient learning?

This question has assumed immediate practical importance because foreign language classes are now being introduced widely into elementary schools in the United States. A very small proportion of elementary schoolteachers have been trained to teach a foreign language -- still fewer, to teach the audio-lingual approach to language teaching which is now preferred -- and therefore many schools have used instructional television to share expert teaching as widely as possible. In these schools the question we have raised was an intensely practical one: What should the classroom teacher do? What activities at school and home could be built around the television to bring about as much learning as possible? And how could the situation be used to raise the competence of teachers in foreign language as rapidly as possible?

These were the questions Denver faced. The Denver Public Schools are the owners and operators of Station KRMA-TV, channel 6, which broadcasts classroom lessons during the day, adult education and general community programs during non-school hours. Preparing to introduce Spanish and French into fifth and sixth grades, Denver decided to build the courses around television.

About three quarters of the 8,000 fifth graders chose to study Spanish rather than French, doubtless because of the greater likelihood of being able to use Spanish conversation in Denver and the surrounding country. Therefore, it is the introduction of Spanish into elementary school that we are going to talk about in this report, and it was the problem of building a context for television in teaching fifth- and sixth-grade Spanish that Denver and Stanford, with the aid of a generous NDEA grant from the United States Office of Education, decided to study.

The problem of the study, in specific terms, was how to introduce and teach Spanish most effectively in elementary school under the conditions pertaining at Denver. In more general terms, however, the problem was the kind of teaching and learning context that would make for maximum learning from instructional television: how to build television into a total learning situation, using the resources available in the modern elementary school. This is what Denver and Stanford were working on from 1960 to the beginning of 1964.

Certain decisions were made by the school system, on the basis of their experience and also in line with previous research and with the advice of expert consultants employed to assist the project staff. For one thing, it was decided that the audio-lingual method of teaching was to be employed: pupils were to be introduced to the language by hearing and speaking it. At some time in the second year of language teaching, the skills of reading and writing the language were to be introduced. There was doubt as to whether the teaching of reading and writing should start at the beginning or the midway point of the second year, and therefore some research was done on this point and will be reported in the following pages.

Let us make clear, however, that the project was not a test of the audio-lingual method against any other method of language teaching. The audio-lingual method was accepted, and was to be used exclusively in the fifth grade and for as long in the sixth grade as experience dictated. The test was, therefore, not of the method, but of how the most effective course could be built using the accepted method.

It was also decided that the television teaching should encourage frequent active responses from the pupils. This was one of the first decisions to be tested by research, and the results, as will be seen later in this report, justified the decision. The teacher would encourage his viewers to name an object aloud or respond in Spanish to a question or a statement, the result being that all over Denver, at a certain hour of the day, fifth- and sixth-grade boys and girls would be chattering Spanish to a teacher they knew only through the picture tube.

It was decided furthermore to keep the conditions of the experiment as representative as possible of those which any good school system could provide in its elementary schools. Thus, for example, language laboratories and other expensive equipment were not used. Denver has some language laboratories in its secondary schools, and could perhaps have made one or more of these available, part-time, to an experimental group of the elementary school language students. But to provide language laboratories for 12,000 fifth- and sixth-grade students of Spanish would have represented a very large expense, and it was decided to postpone this. On the other hand, tape recorders and record players in small numbers could be made available easily and at relatively low expense, and so these were made a part of the experiment. In general, an attempt was made to do nothing in the experiment that would set it apart from what other school systems like Denver could afford to do.

Three half-hour periods per week were assigned to foreign language in each of the two grades. Fifth-grade lessons were broadcast three days a week -- Monday, Wednesday, and Friday; sixth-grade lessons, two days a week, on Tuesday and Thursday. Each of the television broadcasts was 15 minutes long. Therefore, the remainder of the time, or 45 minutes per week in the fifth grade and 60 minutes in the sixth grade, was available for classroom teaching of the language. This is a modest allocation of time, and considerably less than the long periods of concentrated practice which teachers of the audio-lingual method sometimes recommend. On the other hand, it is a feasible amount of time, an addition to the elementary school curriculum which most schools would find not too difficult. In this respect, as in others, the effort was made to do at Denver, not what a laboratory school could do, or what might be done briefly with the financial aid of a research grant, but rather what might be done under typical conditions by a representative city or county school system.

Inservice training and the upgrading of elementary schoolteachers in the skills of teaching foreign language were among the important objectives, but here, too, certain limiting decisions were made. The goal was not to prepare every teacher to be an expert in teaching a classroom course in audio-lingual Spanish without aid from television, but rather to make every teacher expert in managing and leading the activities that were to go on, in the classroom, in connection with the television. This is no small objective, requiring, as it proved to require, skill in conducting various kinds of language drill, managing various kinds of practice such as programmed instruction and electronic aids, and providing motivation and transition between these activities and the television, but it is still a more feasible goal than the requirement of being able to give the course without any outside aid.

In the Denver schools, the concept was that a team should teach elementary school Spanish. There would be an expert language teacher on television. There would be another teacher in the classroom, expert in managing the things that would combine with television.

This teacher would have such aids as turned out to be significantly useful -- some of these, like programmed instruction, language records or tapes, and handbooks, themselves representing the work of expert teachers. It was thought that the parents, too, should be offered a place on the team, and some of the most interesting results of the experiment came from the enlisting of parents in the activity.

The three years of research reported in this book were, then, essentially experiments in finding the most effective activities and combinations of activities and materials for this team -- aiming always at improving the instruction and increasing the amount that students would learn within an allocation of curricular time and under conditions that would prove feasible for a very large number of elementary schools.

The Television

Let us begin with a few words about the television for which Denver was trying to provide an instructional context.

The Denver schools decided, after looking over what was available in 1959 and 1960, that they would have to make their own Spanish television programs. Therefore, they selected Fred Manzanares, a young and successful teacher, of Spanish-American parentage, and assigned him, with the aid of KRMA-TV producers and technicians and members of the Foreign Language Department of the Denver schools, to prepare and record approximately 150 15-minute television lessons for fifth and sixth grades.

These recorded courses, "Hablo Español" and "Hablo más Español," are now available from the Instructional Television Library, at the University of Nebraska, in Lincoln. Outside observers who have seen or sampled the programs have remarked on Manzanares' friendly and vivacious manner, and his ability to call forth responses from the audience. The programs are active and conversational, with Manzanares talking (mostly in Spanish) to other persons on the screen and often to the audience itself. He frequently waits and listens for the viewers' answer. A high proportion of the programs are built around a situation in everyday life -- a family at dinner, shopping in a store, playing a game, celebrating a holiday in the Spanish manner, or something of the kind. On almost every program, children of fifth- or sixth-grade level take some part; on about half of the programs, Manuel Andrade, another young and highly regarded Denver teacher, and Mrs. Andrade appear as the mother and father of the TV family. Sometimes other teachers are in the "cast". Every effort is made to keep the conversation as natural as possible. In general, the television teaching appears to have been a pleasant experience for the pupils who were exposed to it, and Manzanares and the Andrades receive friendly greetings (in Spanish) in all parts of the city from fifth- and sixth-graders who have never seen them except on television.

Classroom Activities and Materials

These recorded television lessons necessarily set basic requirements for other materials to be used in the course. The vocabulary decided upon for the television had also to be the basic vocabulary for the classroom drills, language records, handbooks, and programmed textbooks. The sequence of new words and concepts in these other materials and practice hours also had, for the most part, to follow the sequence of the television. Thus Denver found itself having to construct a large proportion of the materials it needed for these courses. For example, even if it had been possible to find a suitable programmed textbook in Spanish at the fifth- and sixth-grade level, it is unlikely that this book would have fitted the vocabulary and sequence of the television courses. The fact that Denver had to make its own was both an advantage and a disadvantage. For one thing, it produced a package of materials that _did_ fit together. Again, it produced some materials -- notably the programmed textbook -- which, because of the ongoing research project, were tested much more thoroughly than most teaching materials usually are. But the preparation of materials was a major job.

The largest of these undertakings was the making of "Automated Spanish," a programmed textbook in several volumes, consisting of about 2300 frames, for the sixth grade. To prepare this book, Del Barcus, a teacher of Spanish, was released on full-time assignment to learn the skills of programmed instruction and write and test the materials. (Barcus has since become the Supervising Teacher in charge of Programmed Instruction for the Denver Schools.) After consulting with persons experienced in programmed instruction, such as Dr. Arthur Lumsdaine and members of the Stanford team, and reading in the theory, he proceeded in the classical way to write a sequence of items, testing them on one student, revising, testing them on another student, revising again, until the sequence was ready to try on a whole class and finally on a large sample of students. This, like all careful preparation of programmed materials, was a long and painstaking task.

The resulting textbook reads much like a pleasant dialogue between teacher and student. The teacher makes a statement or asks a question, and the student responds by filling in a blank. For example, at the very beginning of the program, the pupil learns that "Maria es una nina." Then he is shown a drawing of a little girl, and reads

Que es esta?
Es una ____________.

The pupil checks his answer opposite the next item. (Es una nina.) He works from simple words and ideas like these to more difficult ones, learning to read and write the words, phrases, and sentences he has already heard in the audio-lingual part of the course. Barcus found it necessary to use rather more orthographic cues (for example, the first letter of the word desired as the response) than in most programs, but the book proved easy to use and popular with both teachers and students. This programmed textbook is available for examination at the Denver schools, and will be commercially available from the Follett Publishing Company, of Chicago.*

Among other materials prepared for the courses were "Leemos el Español," a non-programmed workbook, also by Barcus, which contains reading, writing, and conversational exercises; a long-play phonograph record, "Hablo Español," using the basic vocabulary of the course and designed to guide the pupil's conversational practice; and handbooks for teachers and for parents who participated.

Helping the teachers follow the prescribed method required not only that materials be prepared but also that inservice training be conducted. We shall describe this training later.

Parent Activities

Parents who volunteered to participate were asked to view with their children a repeat of the televised class in the early evening, and to practice the language with their children. To help with the practice, they were given the long-play record "Hablo Español," and a printed guide which told them what materials would be given in each lesson, and provided some patterns for drill and practice.

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*For a detailed account of the making of these programmed materials, see Barcus, Delbert L., Hayman, John L., Jr., and Johnson, James T., Jr. Development of Programmed Learning Materials for Use with Televised Spanish Instruction. Report No. 4, 1961.

The Research Design

We have now named the major elements in the learning situation with which we could work. These can be expressed schematically as follows:

Pupils		Teachers		Television		Classroom activities and materials	
5th and 6th grade pupils with different abilities, backgrounds, and interest	+	an expert teacher on television; less specialized teachers in classrooms, with different levels of interest in and preparation for teaching the language	+	45 minutes per week of televised teaching in 5th grade; 30 minutes in 6th	+	drill of several kinds, programmed instruction, electronic aids, workbook, extended reading, "Spanish corner," others	+

Parents		Home activities		Criterion measures
with different backgrounds, interest, and willingness to participate	+	several kinds of homework with or without parent participation	+	improvement in: listening comprehension, speaking ability, reading and writing, interest

Among these elements, we could vary:

The television -- to a certain extent we could experiment with the form of the television teaching; and we could test the usefulness of a second viewing of the televised lesson.

The classroom activities -- we could test the relative effectiveness of several different kinds of classroom practice conducted by the teacher; the usefulness of such electronic aids as record players and earphones; the usefulness of programmed instruction, and of variations within the programmed materials; of workbooks, extended reading, "Spanish corners," and certain other classroom activities aimed at stimulating the learning of Spanish; and a variety of combinations of these.

Home activities -- we could test the effectiveness of certain kinds of homework, and of the participation of parents with their children in their home activities.

Timing -- we could test the usefulness of introducing the study of reading and writing and the use of programmed instruction, among other activities, at different points in the course.

In addition to these elements which we could control, we had to consider certain other variables over which we had no control but had to be aware of in interpreting our results. Among these perhaps the most important was student ability -- intelligence, verbal aptitude, foreign language aptitude, previous acquaintance with or performance in Spanish if any, interest in the course, and the like. Almost equally important were variations in the training and preparation of teachers to teach Spanish, and their interest in doing so. Also important were the attitudes of parents, and their education and previous acquaintance with Spanish. As might be expected, we found that certain activities and combinations of activities had quite different results on classes where the student, teacher, or parent variables were different.

Finally, at different points in the two years of Spanish we had different output variables to measure. In the first place, the important measures were listening comprehension -- ability to understand the spoken language -- and ability to speak the language. In the second year, in addition to these measures, it was necessary also to test the pupils' ability to read and to write the language. Throughout we were concerned with the attitudes of pupils toward the course.

It goes without saying that not all these outputs were equally easy to measure.

To sum up, then, we could control a large number of possible variations of televised teaching and its context, which we could test against different combinations of teacher, pupil, and parent variables, and the outputs of which we could measure in several different ways. The general tactic was to vary systematically the elements in the learning situation which we could vary, to test different treatments and combinations, and gradually to identify the most effective combinations for different situations.

There were many more possible combinations than a medium-size research operation could handle in three years, and far more than a school system could absorb in that length of time without serious disruption. But it was not necessary to try all possible situations. We endeavored in each case to test some of the crucial variables first, and to select the most likely ones to combine with others.

For example, at the very first we tested several forms of television teaching -- the typical lecture form, a very active form of teaching that encouraged audience responses, and a form in which pupils on camera as well as pupils in the audience made responses. On the basis of this test, it was decided to use throughout the experiment the active, response-encouraging form of television teaching, with pupils in the studio to pace the teacher and a number of pupils also playing parts in the televised program.

The first full year of the study was concerned with the fifth grade, where all the teaching was audio-lingual. Here one of the crucial questions to be answered was the relative effectiveness of different forms of classroom practice -- dialogue, structure drill, and eclectic -- used as adjuncts to television. As a result of what we found, it was possible to go ahead confidently with the eclectic form in the later years of the project. It also seemed important to test the effectiveness of a second showing of the television program for home viewing, and of adding parent participation to the repeat showing. We found that parent participation was apparently very useful, and it was therefore used in different combinations during the second and third years of the study. Certain puzzling results of the repeat showing, however, led us to test it in different ways during the second year of research.

When we came into the second year, and extended the study to the sixth grade, where reading and writing of Spanish were to be taught for the first time, one of the most urgent questions was one of timing: should the study of reading and writing be introduced at the beginning of the year or the beginning of the second semester? This was, therefore, studied, and as a result it was found desirable to begin reading and writing in the first month of the second school year. It was also possible to find out whether the use of electronic aids (phonograph records or tape recorders, with earphones) made a contribution to learning. And there were many questions to be answered about the programmed textbook: did it contribute to the pupil's total learning? was it more useful for some kinds of pupils than others? when was the best time to introduce it? The research was designed to get answers to these basic questions, so that the most effective materials and practices could then be tried in ever-more-promising combinations.

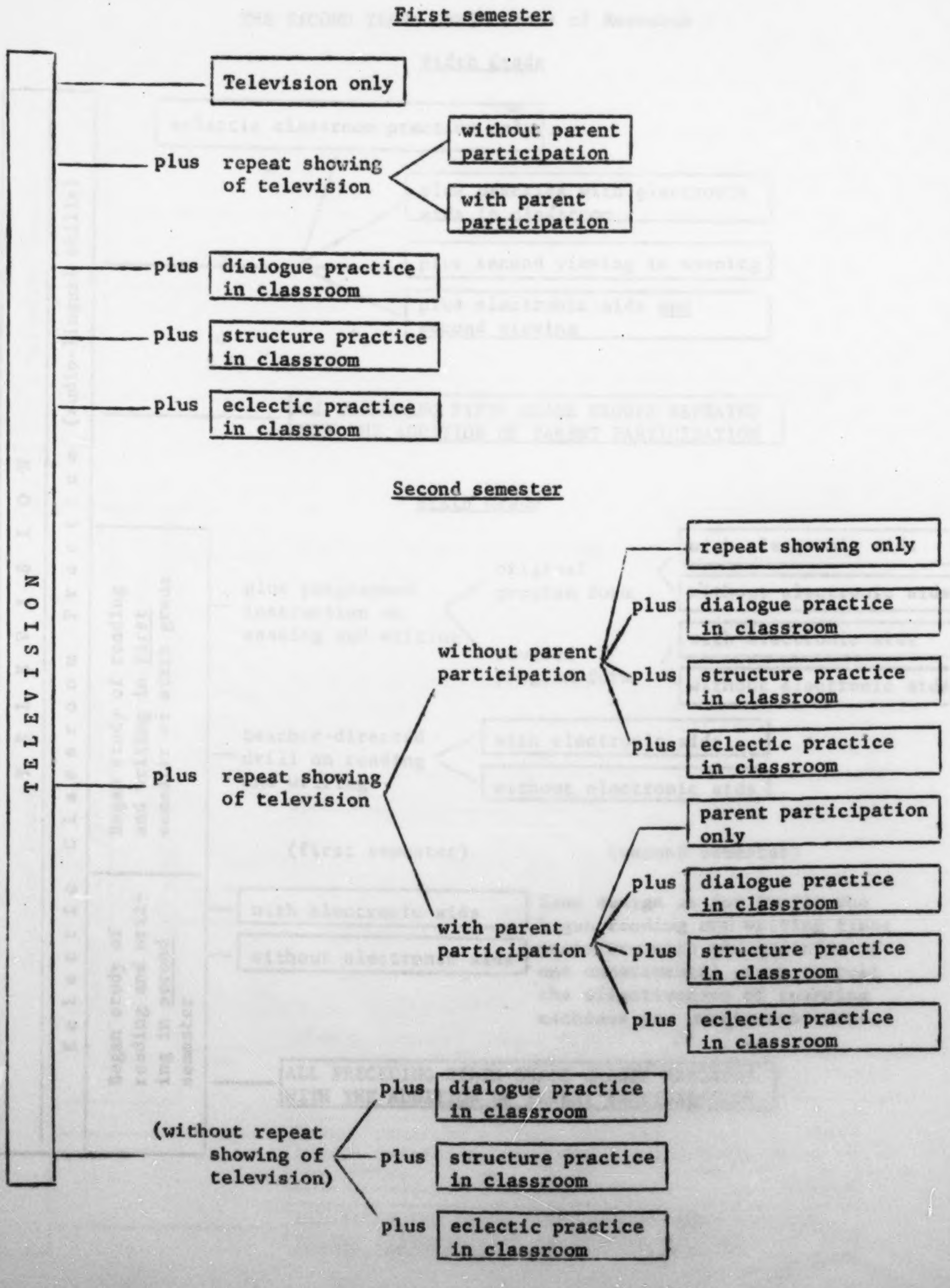
The strategy, then, was to start with what seemed like key questions, sort out the more effective treatments, try promising combinations against other combinations, vary the design from semester to semester so as to test the maximum number of important decisions, and gradually to emerge with the most successful patterns and some of the principles behind them. In the third year, we were able, not only by special studies (including a survey of participating parents and an experiment involving teachers' choice of materials available) to resolve some of the puzzling questions which had raised themselves to view in the first two years, but also to test large combinations of the most effective and promising treatments.

The main lines of research are diagrammed in the three following pages. In addition to these, certain special studies were made which will be described later in this report.

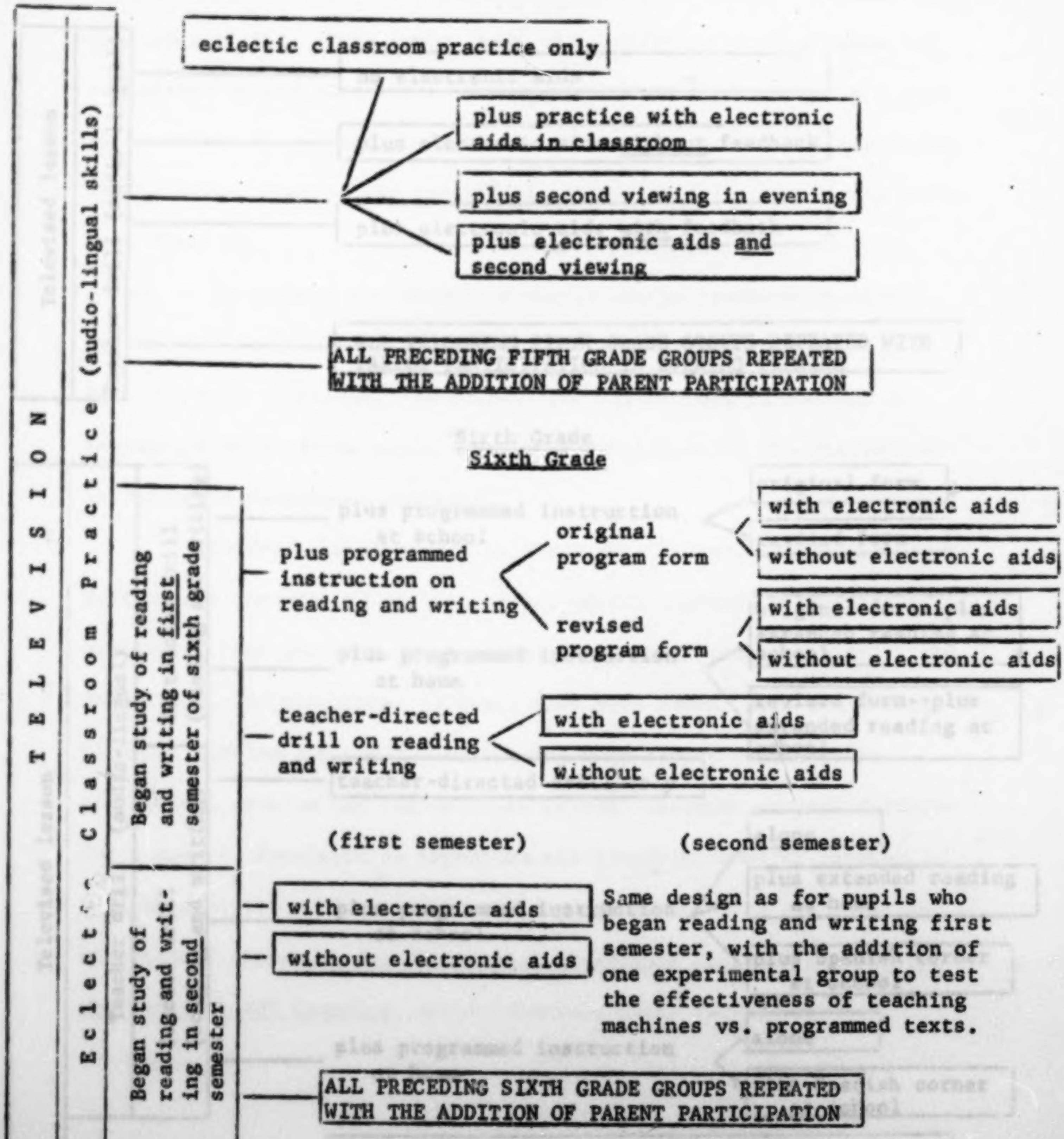
Sample

We were able to handle a large and complex design like this because of the wonderfully cooperative attitude of Denver teachers, students, and parents, and because of the large number of classes and students available for study. In each year in each grade, over 6,000

THE FIRST YEAR: Main Lines of Research (fifth grade only)


First semester
TELEVISION
Television only
plus repeat showing of television
without parent participation
with parent participation
plus dialogue practice in classroom
plus structure practice in classroom
plus eclectic practice in classroom
Second semester
plus repeat showing of television
without parent participation
repeat showing only
plus dialogue practice in classroom
plus structure practice in classroom
plus eclectic practice in classroom
with parent participation
parent participation only
plus dialogue practice in classroom
plus structure practice in classroom
plus eclectic practice in classroom
(without repeat showing of television)
plus dialogue practice in classroom
plus structure practice in classroom
plus eclectic practice in classroom

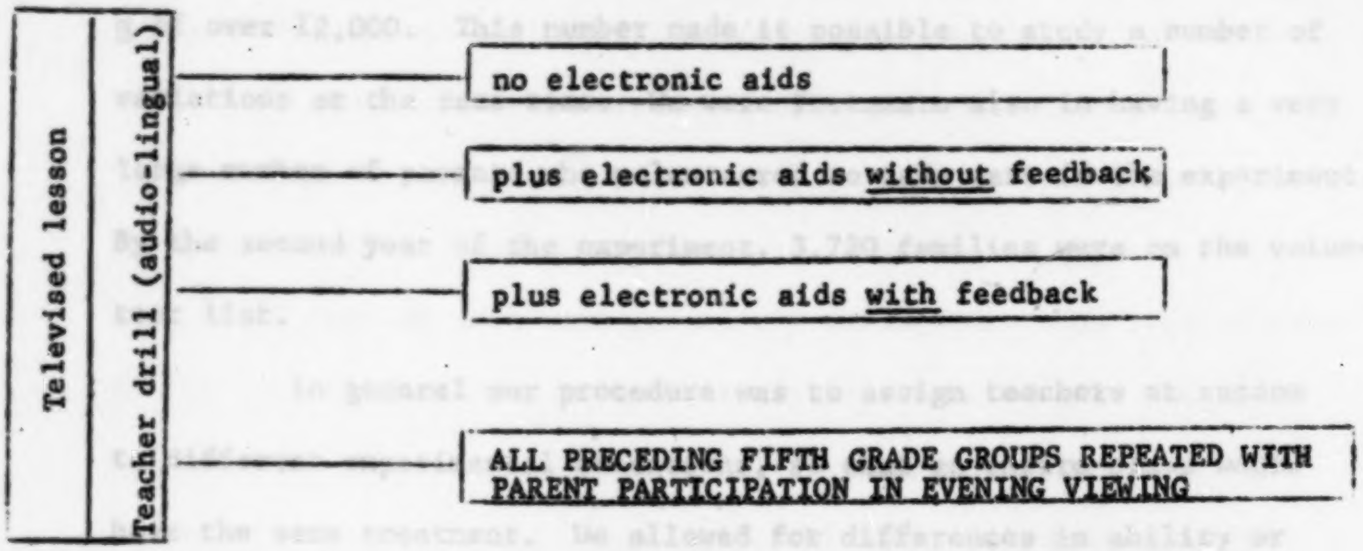
THE SECOND YEAR: Main Lines of Research


Fifth Grade
T E L E V I S I O N
Eclectic Classroom Practice (audio-lingual skills)
eclectic classroom practice only
plus practice with electronic aids in classroom
plus second viewing in evening
plus electronic aids and second viewing
ALL PRECEDING FIFTH GRADE GROUPS REPEATED WITH THE ADDITION OF PARENT PARTICIPATION
Sixth Grade
Began study of reading and writing in first semester of sixth grade
plus programmed instruction on reading and writing
original program form
with electronic aids
without electronic aids
revised program form
with electronic aids
without electronic aids
teacher-directed drill on reading and writing
with electronic aids
without electronic aids
(first semester)
(second semester)
Began study of reading and writing in second semester
with electronic aids
without electronic aids
ALL PRECEDING SIXTH GRADE GROUPS REPEATED WITH THE ADDITION OF PARENT PARTICIPATION

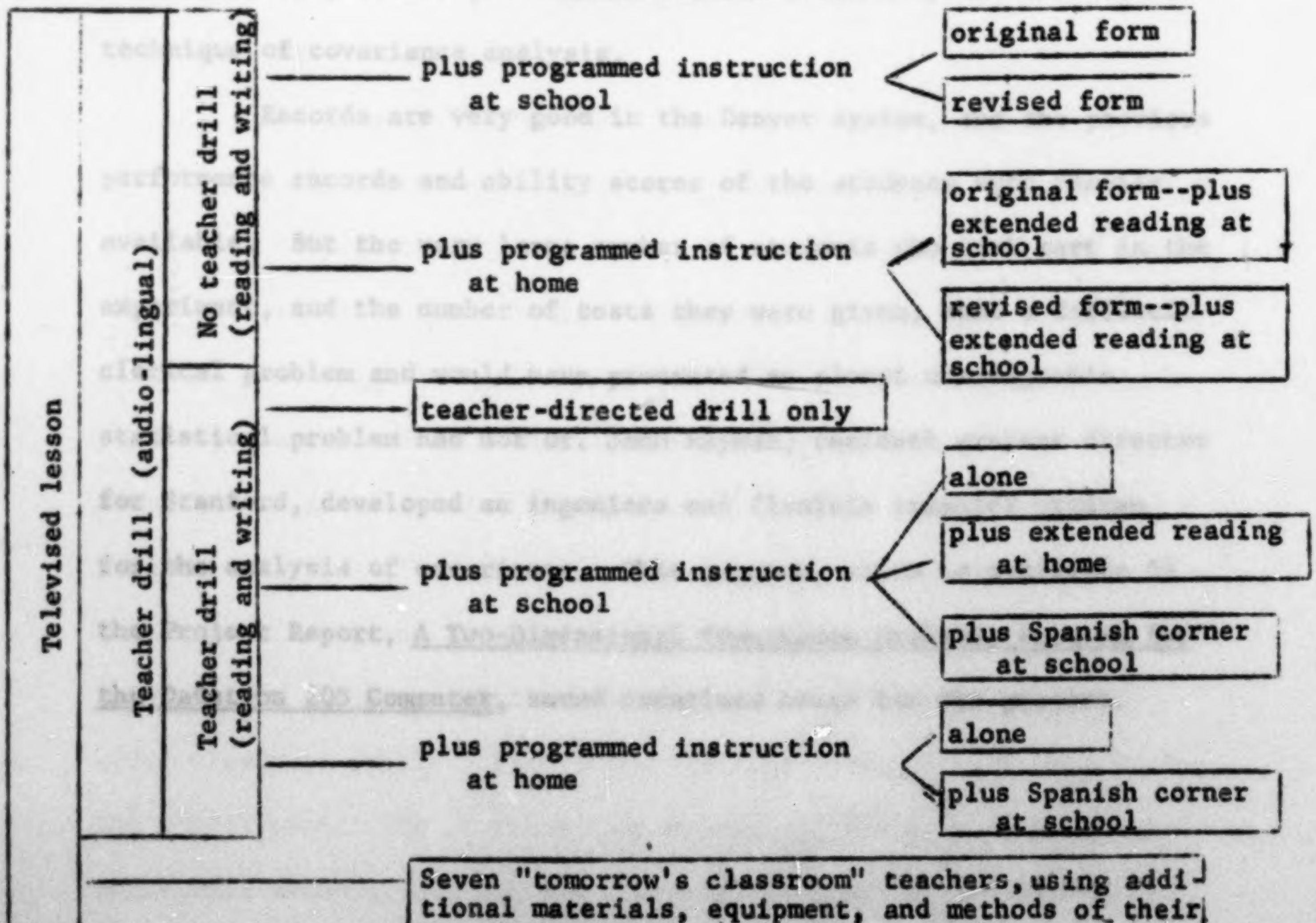
Same design as for pupils who began reading and writing first semester, with the addition of one experimental group to test the effectiveness of teaching machines vs. programmed texts.

THE THIRD YEAR: Main Lines of Research

Fifth Grade


Televised lesson
Teacher drill (audio-lingual)
no electronic aids
plus electronic aids without feedback
plus electronic aids with feedback
ALL PRECEDING FIFTH GRADE GROUPS REPEATED WITH PARENT PARTICIPATION IN EVENING VIEWING

Sixth Grade


Televised lesson
Teacher drill (audio-lingual)
No teacher drill (reading and writing)
plus programmed instruction at school
original form
revised form
plus programmed instruction at home
original form--plus extended reading at school
revised form--plus extended reading at school
teacher-directed drill only
Teacher drill (reading and writing)
plus programmed instruction at school
alone
plus extended reading at home
plus Spanish corner at school
plus programmed instruction at home
alone
plus Spanish corner at school
Seven "tomorrow's classroom" teachers, using additional materials, equipment, and methods of their own choice
ALL PRECEDING SIXTH GRADE GROUPS REPEATED WITH PARENT PARTICIPATION IN EVENING VIEWING

students in 90 different schools were enrolled in Spanish. Thus we had in the second and third years of the study a possible experimental _n_ of over 12,000. This number made it possible to study a number of variations at the same time. We were fortunate also in having a very large number of parents who volunteered to take part in the experiment. By the second year of the experiment, 3,720 families were on the volunteer list.

In general our procedure was to assign teachers at random to different experimental conditions, so that an entire class would have the same treatment. We allowed for differences in ability or experience or previous performance between classes by the statistical technique of covariance analysis.

Records are very good in the Denver system, and the previous performance records and ability scores of the students were readily available. But the very large number of students who took part in the experiment, and the number of tests they were given, made a difficult clerical problem and would have presented an almost unmanageable statistical problem had not Dr. John Hayman, resident project director for Stanford, developed an ingenious and flexible computer program for the analysis of covariance. This program, which is available in the Project Report, _A Two-Dimensional Covariance Analysis Program for the Datatron 205 Computer_, saved countless hours for the project.

Teacher Training

Another activity that was exceedingly important to the research design and to the general purpose of the study needs to be mentioned: the activity in teacher training. Even without a project, of course, it would have been desirable to give the teachers as much help as possible, inasmuch as they were beginning to teach a subject with which most of them were relatively unfamiliar. The requirements of the project, however, made it doubly important to give them training in order that they could skillfully and uniformly carry out the different classroom practices required of them, and so that consequently the investigators would know just what experiences and practices they were comparing.

The program of inservice training conducted during the first year of the experiment will illustrate what was done. A summer workshop, with college credit, was organized, and 50 teachers, just over one fourth of those who were to teach Spanish in the fifth grade, attended the workshop in the summer of 1960, just before the first year of research. Before any classes had met, all the teachers of Spanish were assembled for a half day, told of the background for the project, its goals, and the kind of cooperation expected of them. Instruction was given in individual procedure, and each group received guides which further explained the procedures to be followed and provided classroom drills. Five other training sessions were held during the school year. Two of these were televised, two were conducted in individual schools, and one was a general meeting at the beginning of the second semester. At each session, teachers were given instructions in the procedures to be followed. The general meeting included also a discussion of results, problems, and plans.

In addition to these formal sessions, members of the staff met with individual teachers during the year to discuss procedures and help with individual problems.

The purposes of all this effort, as we have indicated, were to make certain that assigned procedures necessary to the research project were followed, and to increase the proficiency of teachers in the subject. Toward this second goal, the television itself made a contribution. All teachers were asked to participate during the television lessons, to follow the instructor closely and to respond when response was requested.

The growth in confidence and skill among the teachers which we shall have occasion to mention in later pages is in no small degree a result of this varied and intensive inservice training.

Tests

Testing the performance of students throughout an entire school system in a modern language course built around television presents certain problems not common to most classroom teaching. Therefore, special attention was given to the making of tests. In each case, first and second semester tests were constructed, with due attention to construct validity, reliability, comprehensiveness, and discrimination, for use throughout the school system. The testing of some of the audio-lingual work required special solutions. In the first year of audio-lingual teaching, for instance, the pupils can neither read nor write in Spanish, and translation to English is strictly avoided. For these pupils, special tests were developed which were administered by television (for uniformity), with the student responding by checking a picture or a number or letter on a paper in front of him. This test is described in a special report of the project.* The measurement of speaking ability also required something other than the typical paper and pencil test. For this purpose, criteria and tests were developed to measure phonetic accuracy (ability to pronounce Spanish sounds properly), structure (ability to compose Spanish sentences orally, using correct syntax and grammar), and fluency (ability to communicate in Spanish with ease and naturalness). Each pupil's performance was recorded on magnetic tape, then evaluated independently by at least two graders. Reliability coefficients of .95 or better were obtained between raters of the same tests, but the process was necessarily far more time-consuming and demanding than most test grading. Furthermore, because the speech test required individual administration, only a random sample of each treatment group could be tested. The making and evaluation of this test is also described in a special report of the project.**

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*Andrade, Manuel, Hayman, John L. Jr., and Johnson, James T., Jr. Measurement of Listening Comprehension via Television in Elementary School Spanish Instruction. Report No. 3, 1961.

**Andrade, Manuel, Hayman, John L., Jr., Johnson, James T., Jr. Measurement of Speaking Skills in Elementary Level Spanish Instruction. Report No. 9, 1963.

The Objective

All this complex and detailed activity, which tested the resources of a research organization and the adaptability of a large school system, was really directed, of course, toward a relatively simple goal: trying to answer in practical terms some of the most urgent questions schools ask about what kind of learning context to provide for instructional television. Some of the complexities will be reflected in the appendix of this report. The realistic answers we were able to find are in the following pages of text.

SUMMING UP

In summary, let us say again that there is no serious doubt that pupils learn efficiently from instructional television. The problem of this study was to find some of the patterns of activities combined with television that would make for the most efficient learning.

The problem was studied in the specific case of elementary school foreign language, where there is a shortage of experienced language teachers, and where it is becoming increasingly common practice to share some of the best teaching by television. The problem was studied in the Denver school system, where foreign language was being introduced in fifth and sixth grades. Because the great majority of Denver pupils chose to study Spanish in elementary school, that was the language studied. The Denver course was designed to begin with an audio-lingual approach to the language, introducing the reading and writing skills at whatever the appropriate time proved to be. Every attempt was made to use resources, time allocations, and classroom practices which would be within the reach of any good school system, and thus to make the results as widely useful as possible.

The concept being tested in Denver was that of a teaching team, though a somewhat different one from the common pattern of "team teaching". There was the expert teacher on television; the classroom teacher, who was not necessarily highly prepared and experienced in foreign language teaching, but was expected to develop the skills of managing a variety of classroom methods, materials, and devices including programmed instruction and electronic aids; and the parent, who could contribute by participating in a second viewing of the television at home, and by practicing with the pupil. The question was by what combination and timing of activities this team could help pupils to learn most.

The study presented considerable problems in logistics and design. Two years of television had to be planned, recorded, and tested. A year of programmed instruction had to be written and tested in the meticulous way that method requires. A non-programmed text, long-playing records, guidance materials, and other materials had to be developed. A large number of input and output variables had to be tested. The strategy of the design was to begin with key questions, sort out effective treatments, and then try promising combinations. A very large experimental population (about 6,000 in each grade in each year), an effective inservice training program and remarkable cooperation from teachers, administrators, and parents, carefully made tests, and computer analysis of data made the task manageable.

2. THE BASIC QUESTION

Let us begin with the question that was basic to all we did: Does a planned context for instructional television make a significant difference in the amount of learning?

We tested this, of course, as soon as we had the materials for testing it, although in a very simple way and with none of the elaborate combinations of context we tried later. To one group of fifth graders we showed only the 15-minute televised lessons, throughout the semester. These lessons were videotaped, and this made it possible to show one experimental group the TV lesson in school, and also to repeat the showing in the early evening -- thus devoting 30, rather than 15, minutes a day to the course. To a third group we showed the televised lesson and the repeat, and also invited their parents to join them in viewing the repeat. A fourth group saw the televised lesson in class, and then had 15 minutes of oral practice under the direction of the classroom teacher. These two latter treatments represented some of the simplest contextual experiences we could provide. At the end of the semester, these were the average scores on listening comprehension* for the four experimental groups:

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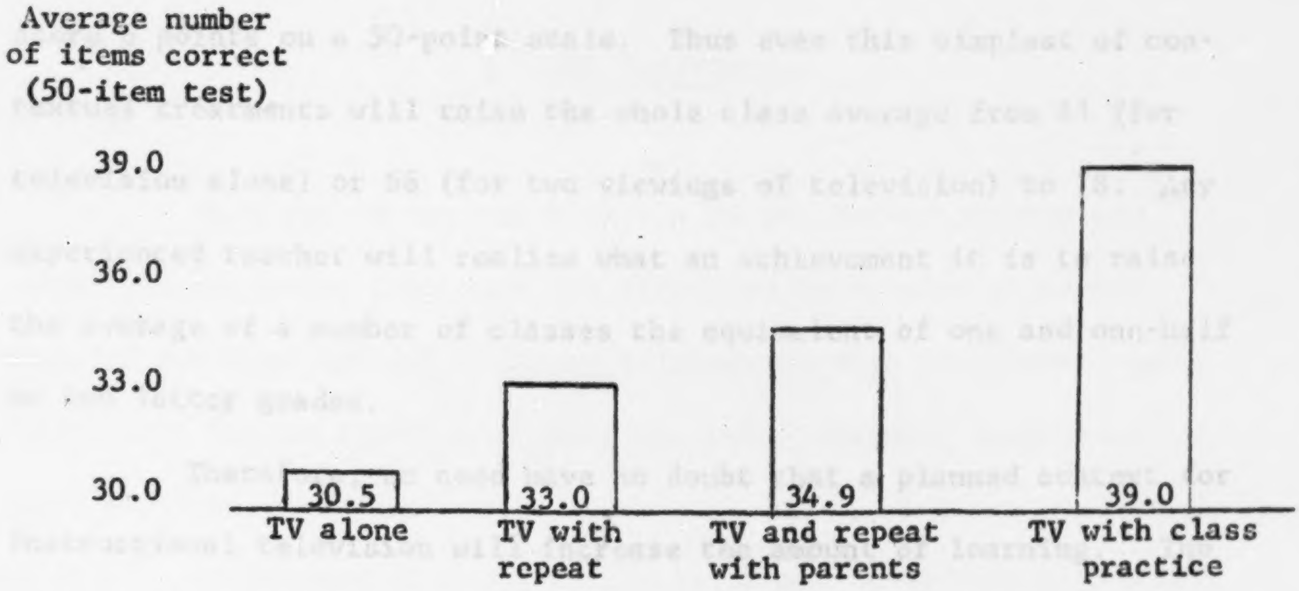
*The experienced reader will ask at this point how we allowed for individual differences in our experimental subjects -- their abilities, previous experiences with Spanish, and so forth. Rather than disrupting the entire school system by trying to reassign students in homogeneous groupings relevant to our topic, we allowed for these differences by the statistical technique of analysis of covariance. In each case an appropriate group of test scores -- IQ, verbal or language aptitude, previous Spanish record, for example -- were used to readjust the means. These are listed in the technical reports of the project.



Each step upward on this chart is statistically significant. That is, repeating the televised lesson will significantly increase the learning over a single presentation. If the parents will join in the second viewing, there is a significant increase in the learning that occurs without their participation. And classroom practice makes for significantly more learning than any of the other treatments.*

How large are these differences? Between the television alone and the television plus classroom practice, the difference is nearly 30 per cent -- between 8 and 9 points on a 50-point scale. But perhaps it is unfair to compare a single viewing of the television with television-plus-practice, because that is comparing 15 minutes a day with 30 minutes a day. Let us therefore compare the two viewings of television with the more effective treatments -- 30 minutes against 30 minutes. In this case, adding the brief practice raises the average score 6 points on a 50-point scale. Thus even this simplest of contextual treatments will raise the whole class average from 61 (for television alone) or 66 (for two viewings of television) to 78. Any experienced teacher will realize what an achievement it is to raise the average of a number of classes the equivalent of one and one-half or two letter grades.

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*For more detail, see Table 5-c, in the Appendix.

Therefore, we need have no doubt that a planned context for instructional television will increase the amount of learning. The next question is, then, what kinds of context are most effective?

SUMMING UP

In summary, then, we can say that even the simplest planned context for instructional television will substantially increase the learning from it. A second viewing of the program will bring about a significant increase. An equivalent amount of time used for classroom practice under the direction of the teacher will raise the semester class average from 61 (for one viewing) or 66 (for two viewings) to 78. Therefore, we are encouraged to look further at the problems of providing an effective context.

But before examining the findings on context, let us look briefly at some things we were able to find out about the television itself.

3. THE TELEVISION

What can we say, as a result of the Denver experiments, about the qualities that made for effective television teaching? Leaving out what was built around television, what was there in the television lesson itself that made the total learning experience more productive or less?

Of all the elements available to us, we varied television the least. There were good reasons for this. For one thing, our interest and our research grant were on the context of instructional television, rather than the television itself. Furthermore, experiments comparing teaching methods on live television are expensive and time-consuming, and we had less than enough time and money to do all the studies we felt were needed on context alone. It should also be explained that many of the variables were taken out of the television situation by the basic decisions about content: the vocabulary, for example, the pace at which the course was to move, the audio-lingual approach, the aspects of grammar that were to be taught.

Still other variables were determined by the choice of a teacher. Doubtless good teaching on television is basically like good teaching anywhere. When the Denver schools chose a young man with a likable personality, a contagious enthusiasm, an excellent command of the language to be taught, and a proved ability to teach effectively in the classroom, and worked out with him course objectives and the general outlines and schedules of a course plan, they not only assured themselves of good teaching on television, but also determined for the most part what kind of good teaching it would be.

What is the effect of eliciting active responses from the television audience, and of providing surrogate responders in the studio?

Nevertheless, we were interested in certain aspects of the television teaching that appeared still to be variable and presented rather intriguing possibilities. We wondered, for example, how effective it is to elicit overt responses from the pupils during the television broadcast. This is something that our television teacher would have done a great deal of, if he were teaching in the classroom. Could he still do it as a television teacher, without feedback from the classroom? And if so, would it make for more learning? Waiting for the pupils to respond would take time from the television teacher's own speaking: would the overt responses from the pupils make for more learning than, for example, using the same time for repetition?

Another question that interested us was the usefulness of peer group models in the television programs. Would it make for more learning if a few pupils from the same grade as the viewers took part in the televised lesson? And if so, how would it help? Would they merely help to involve the viewers? Would they effectively serve as surrogates for the viewers, by responding for them? Would they pace the television teacher, so that he could present material at an effective rate, and wait the right length of time for pupil responses?

We got two answers to these questions without having to do research on them. In the first place, it was easy for the television teacher to elicit overt responses from his audience in the classrooms. All over Denver, his pupils spoke up almost as though he were himself in the classroom. (As we shall point out a little later in this chapter, the amount of overt response depended to some extent on where the pupils sat in the classroom; but regardless of seating, there was a great deal of active participation.) And in the second place, the presence of peer group models in the studio and preferably on camera was a great aid to the television teacher in helping him to pace his teaching. We gathered systematic information on these points, but it was hardly necessary; the conclusion was foregone once a few lessons had been put on the air.

To dig more deeply, however, we conducted two experiments, one in 1960 before the principal research on context had begun, the second a replication in 1962 with certain additions and refinements. In the first of these we compared three forms of television teaching: one in which the teacher merely talked to his viewing audience without asking them to respond overtly (we shall call this the repetition form); a second in which, without the aid of pupils in the studio to guide his timing, he did ask for a number of active responses from the audience (we shall call it the rehearsal form); and a third in which he used peer group models in the studio and asked both them and the audience for a number of active responses (call it the models form). Because at that time we had not yet developed a reliable test of ability to speak the language, we measured the results on listening comprehension only. The differences were just shy of being statistically significant at the .05 level, and therefore any conclusions we draw concerning them must be regarded as suggestive only. But the models treatment worked best, the repetition form was only slightly less effective, and the rehearsal treatment was considerably less effective than the others, one reason apparently being the lack of pacing.*

When we replicated the experiment, we retained the repetition treatment and also the rehearsal treatment to which we added studio models who served to pace the teacher but were not seen on camera. We also used two treatments involving peer group models on camera -- one (models with rehearsal) in which the models responded actively and the classroom pupils were also asked to respond actively; and another (models without rehearsal) in which the models responded for the audience, so to speak, but the pupils in the classroom were not asked to respond overtly. This time we measured the effects on listening comprehension and on ability to speak the language. Once again we just failed to find differences that were over-all statistically significant. As a matter of fact, the average of the experimental groups for three treatments (repetition, rehearsal, and models with rehearsal) were within two-tenths of a point, on a 35-point test of listening comprehension, of each other. The models without rehearsal group scored about a point less, which may have been due, as we began to suspect from secondary analysis, to a real difference in the effectiveness of the teacher with this particular treatment. On the speaking test, the rehearsal form (in which the television teacher was paced by pupils in the studio who were not seen on television, and the classroom audience responded actively) gave considerably better results than the other treatments, although here again, perhaps because of the small numbers who were given the individual speaking test, the differences were just beyond the borders of statistical significance. This figure may be of help in visualizing the results on the speaking test:

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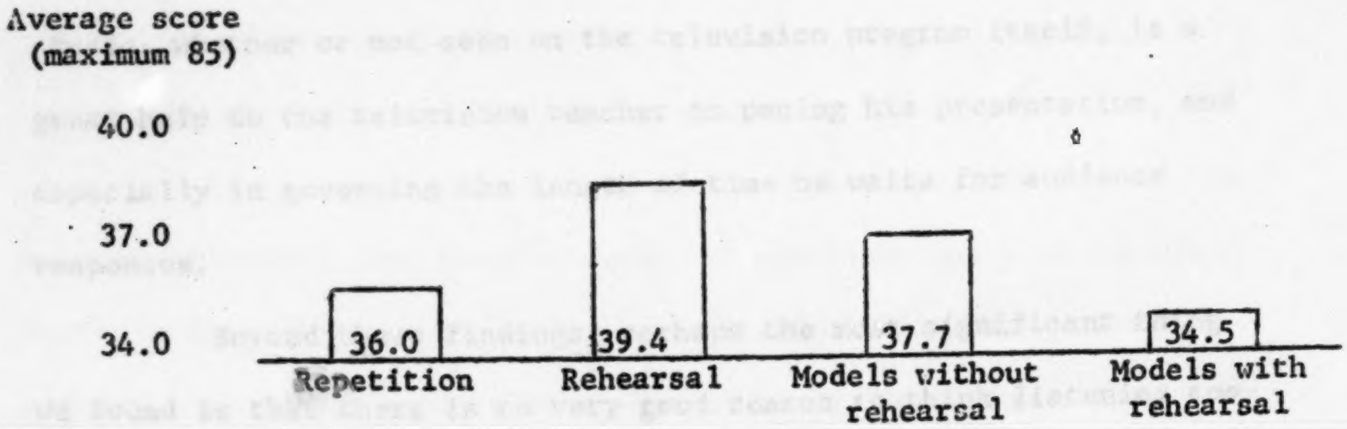
*For a full account of this experiment, see the unpublished Stanford doctoral dissertation by John L. Hayman, Jr., "A Comparison of Three Presentation Methods in Educational Television Instruction," Stanford, 1961. There is also a brief summary in Report No. 3 of this project. The principal data are in Table 1 of the Appendix to this volume.

In this experiment as well as the replication, we had considerable difficulty trying to control the presentation so as to put on the air really comparable treatments. If the same teacher taught the different methods, we were left with the suspicion that he taught one more "naturally" than the others. If a different teacher were used for each, it was hard to be sure that the quality or content of the teaching were exactly equivalent. Furthermore, the expense and trouble of putting parallel treatments on live television led us to teach short units -- two 15-minute classes plus a televised test for the first experiment, three and a test for the replication -- and to relatively small samples. This made it more difficult to find significant differences if they existed.



In addition to these results, we did find one statistically significant difference -- in the amount of incidental learning. Certain words and phrases were rehearsed in the television presentations; certain ones were not. The rehearsal group, which had done the best on the speaking test, also did better than any of the other groups on the test of comprehending the incidental vocabulary of the program. In fact, its performance in this respect was better than that of any of the other groups, at the .001 level of significance.*

What guidelines to effective use of television for teaching elementary school foreign language emerge from these studies? We must be cautious, of course, in drawing conclusions because of the few significant differences obtained. Two of the more useful findings, however, do not depend on statistical significance, and we can state them with confidence. For one thing, a television teacher has no great difficulty in obtaining active responses from his classroom audience. And in the second place, the presence of pupils in the studio, whether or not seen on the television program itself, is a great help to the television teacher in pacing his presentation, and especially in governing the length of time he waits for audience responses.

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*For main results of this experiment, see Table 2, in the Appendix.

Beyond these findings, perhaps the most significant thing we found is that there is no very good reason to think listening comprehension cannot be taught about as effectively without as with active responses from the classroom audience. We can only speculate, of course, as to why active response should apparently be more useful in learning to speak the language than in learning to understand it when heard, but the difference makes sense. One learns what he practices, and in this course he is practicing the spoken language. Furthermore, if the television teacher does not take time to elicit audience responses, he can devote more time to repetition of the phrases and words he is trying to teach his audience to recognize. In one case, repetition contributes to practice chiefly in recognizing and understanding the language; in the other, rehearsal contributes to practice in speaking it. *It would seem that an ideal television* course, built around the audio-lingual method, would therefore try to arrive at some optimum balance of repetition (by the teacher) and rehearsal (by the pupil).

Why, then, did the pupils who responded actively learn more of the incidental material of the lesson, as opposed to that which was repeated and stressed? We can only speculate that it may have been because the expectation of being asked to respond kept them more alert than the others. This problem awaits more study.

It is a good principle that if both teacher and pupils like a teaching method, one doesn't change it unless he has good reason to think that another is more effective. The Denver television teacher enjoyed teaching in a way that called on his audience for active responses. The pupils liked to respond. They liked occasionally to see some of their peers on the program, and having pupils in the studio, whether or not they appeared on camera, was of great help to the teacher in pacing his performance. We had no reason to think that active responses handicap pupils significantly in learning listening comprehension, and at least some reason to think that they help the pupils learn to speak the language. We also had reason to think that active responses might keep pupils more alert to the incidental parts of the televised lesson. Therefore, Denver went ahead with televised teaching that asked for a number of overt responses from the classroom viewers, and was recorded with pupils in the studio.

Does it make a difference where a pupil sits in the classroom when he is taught by television?

We thought we saw some evidence that pupils who were not seated directly in front of the classroom television receiver were not responding to the television teacher so often or so enthusiastically as other pupils were. Therefore, we designed an experiment to find out whether the location of seating in the classroom actually made any difference in the amount learned from the television course.

There is some evidence from research on military training by film that some viewing angles are better than others when the learning task demands special visual acuity. Gibson* found that an angle of 45 degrees from the screen was satisfactory when attention has to be focussed on small items. Ash and Jaspen** found that naval trainees performed better, on tasks requiring visual acuity, when the angle was not more than 30 degrees from the screen, and the distance not more than 12 screen widths. Whether these findings also apply to television is not known. The only recommendation we have found on seating position in television classrooms is that of the Educational Facilities Laboratories, which say that for a 21-inch screen, 19 feet is the maximum efficient viewing distance, and 45 degrees is the maximum efficient viewing angle. A reduction of the angle to 40 or even 30 degrees is recommended for tasks where visual acuity is critical. No evidence is given to support these recommendations.***

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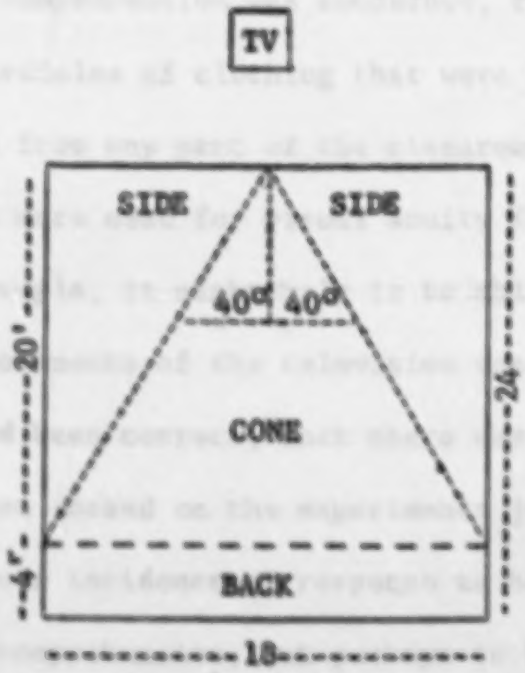
*Gibson, J. J., editor. Motion Picture Testing and Research. Report No. 7. Army Air Forces Aviation Psychology Program Research Reports. Washington, D. C.: Government Printing Office, 1947.

**Ash, Philip, and Jaspen, Nathan. Optimum Physical Viewing Conditions for a Rear Projection Daylight Screen. Technical Report SDC 267-7-37. Instructional Film Research Program, Pennsylvania State University. Port Washington, New York: Special Devices Center, October, 1953.

***Educational Facilities Laboratories. Design for ETV: Planning for Schools with Television. New York: Educational Facilities Laboratories, 1960.

We decided to test a vewing angle of 40 degrees. For the typical Denver schoolroom, the seating space is about 24 by 18 feet. The television receiver has a 21-inch screen and is typically placed at the front center of the room. Thus it was possible, on the seating plan for every classroom, to indicate which desks were outside the 40-degree cone, and which ones were farther than 20 feet from the television set. The diagrams looked like this:



The desks in the center section we designated as in the "cone", those outside the cone as "side" positions, and those farther than 20 feet back in the room as in the "back". Then we proceeded to test the amount of learning that took place in each of these sections of the room.*

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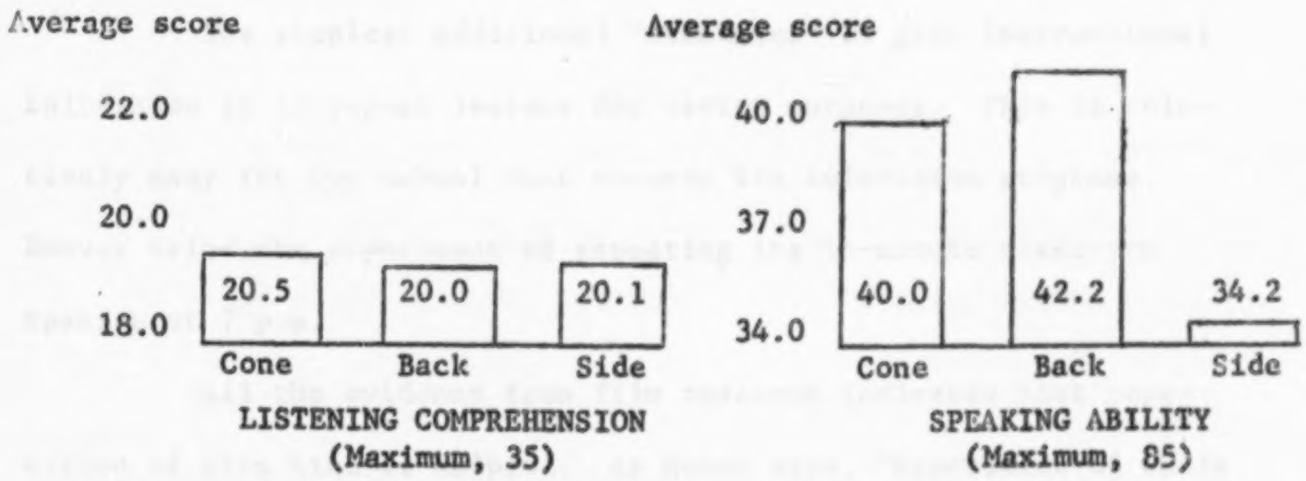
*A report of this study will be found in Hayman, John L., Jr. "Viewer Location and Learning in Instructional Television." Audio-Visual Communication Review, 11: 27-31, May-June, 1963. The basic data will also be found in Table 3 of the Appendix.

In order to avoid the effect of prior Spanish teaching, we used fourth graders for subjects, and retained the seating assignments already made by the teacher. Then we videotaped and presented three 15-minute lessons dealing with the Spanish names for articles of clothing, and measured the results both in terms of listening comprehension and speaking ability.

What should we expect to find? Our learning task, at least so far as listening comprehension was concerned, required no special visual acuity; the articles of clothing that were being identified could easily be seen from any part of the classroom. On the other hand, there might be more need for visual acuity in learning to speak the sounds -- for example, it might help to be able to watch closely the lip and tongue movements of the television teacher. If our previous observation had been correct, that there was less responding outside the cone, then (based on the experiments just described) we should expect the lower incidence of response to have little or no effect on listening comprehension, but perhaps to have some effect on the speaking. In general, then, we should expect seating position in the classroom to have more effect on learning to speak, than on learning to understand, the language.

And this is precisely what we found. The differences in the test of listening comprehension were small and not statistically significant. The differences in the test of speaking ability were significant, and, in fact, pupils in the best positions scored on the average almost 25 per cent better than those in the least favored one, as this figure shows:



Clearly a pupil in a side position, more than 40 degrees from the receiver, is disadvantaged in learning to speak a foreign language taught by television. Whether this is the result of being less well able to see the television teacher's facial movements, or from feeling less directly involved in the teaching (the teacher is not teaching so directly to him) and therefore responding less, we do not know; but it is a significant effect. On the other hand, the student more than 20 feet from the receiver is at no apparent disadvantage.

This presents a problem for schools in which classrooms were designed before the coming of instructional television. In some rooms, it may be possible, and advantageous, to move the television receiver farther back from the seats; in others, to place it in a corner of the room. Or it may be possible to revise the seating plan to put a larger proportion of the pupils into the central cone.

Is it helpful to repeat a televised lesson for review?

The simplest additional "treatment" to give instructional television is to repeat lessons for review purposes. This is relatively easy for any school that records its television programs. Denver tried the experiment of repeating its 15-minute classroom Spanish at 7 p.m.

All the evidence from film research indicates that repetition of this kind is helpful. As Hoban says, "Repetition of whole films, repetition of scenes and sequences, repetition of illustrative examples, repetition in films and film strips, repetition in review and discussion of film content -- all these have been investigated and, in general, all have resulted in increments in learning."* The expectation, therefore, is that repeating a televised lesson would make for more learning by the pupils who watched the repeat. And this is what was found.

When the fifth-grade Spanish lessons were rebroadcast in the evening, and certain pupils assigned to view them, these pupils learned significantly more (at the .001 significance level) than the pupils who viewed the lessons only once.** This was the order of the difference:

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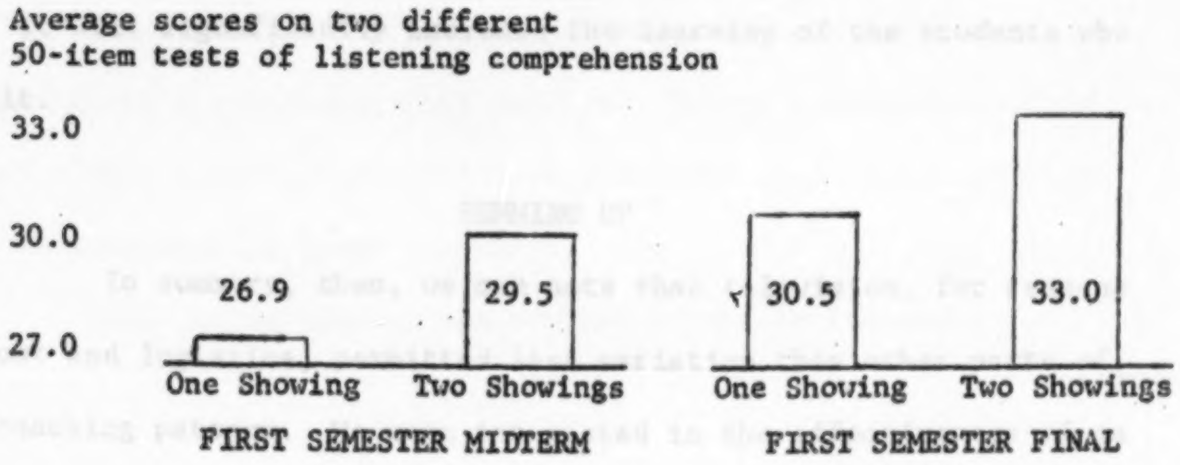
*Hoban, Charles F. "The Usable Residue of Educational Film Research." In New Teaching Aids for the American Classroom. Stanford, California: Institute for Communication Research, 1960. p. 105.

**See Tables 4 and 5, in the Appendix.



In all fairness it must be pointed out that these differences, although highly significant in statistical terms, do not represent one of the more powerful effects we found. For example, if there were a choice of repeating the 15-minute televised lesson or using the same time for classroom drill, (as we shall see) it would be much more effective to use the time for drill. In fact, nearly any of the classroom treatments, added to a single viewing of the televised lesson, are more effective than a repeat viewing. However, there are certain conditions under which a repeat viewing is especially useful. We shall see in a later chapter that one of these conditions occurs when the teacher is not well prepared for teaching Spanish (see p. 52). And there are other situations in which this finding may be particularly valuable. For example, where the television reaches students away from school, where printed workbooks are not available or (as in audio-lingual language teaching) not allowable, or where classroom teachers are not available for the course, then a school may with confidence schedule a repeat showing of the televised lesson, knowing that it will significantly increase the learning of the students who use it.

SUMMING UP

In summary, then, we can note that television, for reasons of cost and logistics, permitted less variation than other parts of the teaching pattern. We were interested in the effectiveness of an active television presentation that would elicit a maximum number of practice responses from the pupils viewing in the classrooms, and we discovered early that it was comparatively easy to elicit such responses. We found also that it helped to have students in the studio, on or off camera, so that their responses could pace the television teacher.

When we conducted two experiments on various patterns of active response compared with lecture teaching, however, we found it harder than expected, in a brief experiment, to produce significant differences related to active responding. Apparently pupils learn listening comprehension skills about as readily without responding actively. The additional repetition which is substituted for responding time probably compensates for the lack of active rehearsal. On the other hand, speaking skills are definitely improved by active responses, and so is incidental learning of vocabulary. The most likely explanation of the finding with respect to incidental learning is that responding actively may keep the pupils more alert.

Repeating television for review purposes contributes significantly to the learning that results. Though significant, this is not a very powerful effect in comparison to some of those which will be described in later chapters.

Now let us turn to the context of the television.

4. THE TEACHER

The most effective "learning aid" which a school can combine with instructional television is a well-prepared and interested teacher.

Some teachers, of course, are more effective than others. We found striking differences in the amount pupils learned from teachers with different levels of preparation and experience, and different degrees of interest in the course. We also found combinations of activities that produced significantly more learning than teacher-directed practice alone. But nothing was so impressive, during the three years of research, as the amount of difference that the classroom teacher was able to make in the effectiveness of different combinations and methods.

Remember that the classroom teacher, on the Denver Spanish-teaching "team", had the special responsibility of managing the classroom activities built around television. The classroom teacher was not required to assume full responsibility for the course. The expert teacher on television paced the course, introduced the new words and phrases, and, together with the electronic aids, provided the master model for speaking the language. The classroom teacher, on the other hand, prepared the pupils for the television and followed up the television with specified practice and drills, assigned the homework and the reading, if any, started the pupils out on their individual activities and stood by to answer their questions and take care of their difficulties. The responsibility of the classroom teacher for motivating the pupils to attend to the television and to carry through their individual practice activities was important. Therefore, although the classroom teacher did not have the sole direction of the course, still his responsibility was considerable.

As might be expected, there was a great variation among Denver elementary teachers who, when the new course was introduced, found themselves teaching Spanish. Some were quite able to conduct the whole course themselves; they spoke Spanish well, and had advanced training in the language. Others were quite new to Spanish, and understandably timorous about teaching it. Very few, before 1960, had taught a foreign language by the audio-lingual method. Especially at first there was a certain amount of reluctance, even fear, to undertake it. Among a few teachers, at first, there was impatience with having to interrupt the face-to-face activities of the classroom to view television: "Now we have to watch that television!" was the way the televised lesson was reported sometimes to have been introduced. On the other hand, many inexperienced teachers were reluctant to have the televised lesson end because that meant they would have to conduct 15 minutes of oral practice. "At first," some of them said, "15 minutes seemed like eternity!"

Therefore, we took pains to measure the experience and preparation of teachers, and also their levels of interest, and set these against the performance of their classes. We were interested also in how the average competence and attitudes changed during the three years, because the course itself was intended to be partly a device for inservice training.

A training and experience questionnaire was completed by all classroom teachers, giving their formal language courses in high school and college, their years of experience in teaching foreign language, the foreign language workshops -- if any -- they had attended, and any experience they had in a bilingual home or in a foreign country using a foreign language. From this record we constructed during the second year an index of experience and preparation, using first-semester listening comprehension results from the classes of half the fifth-grade teachers as a criterion, and cross-validating the scale with the other half of the teachers. Bilingual experience seemed to have no effect on pupil performance, and was therefore dropped from the scale, leaving these items:

Formal training:

1 = none

2 = a foreign language other than Spanish in high school, but no further training

3 = Spanish in high school, but no further training

4 = one year of foreign language in college

5 = two or more years of foreign language in college

Foreign language teaching experience:

1 = none

2 = taught Spanish one or two years, or taught French one or more years

3 = taught Spanish three or more years

Workshop attendance:

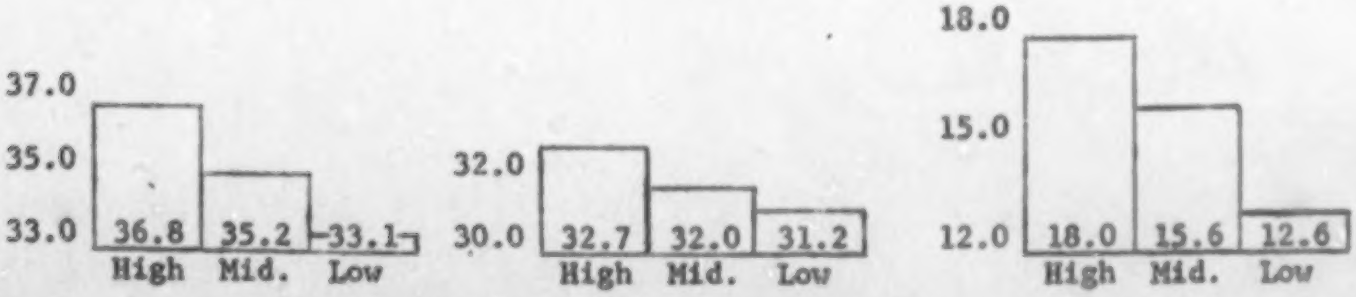
0 = never attended a foreign language workshop
1 = attended one or more foreign language workshops

Formal training was weighted three, experience and workshop attendance one each, thus making possible a range of scores from 4 to 19. Teachers were divided into three groups on their scores: low (4 to 7 points), middle (8 to 13 points), and high (14 to 19).

The Educational Testing Service, of Princeton, New Jersey, for their own purposes as well as ours, developed a test of teacher interest in the teaching of Spanish, which we also administered to all sixth-grade teachers the third year, and two brief tests of pupil interest in Spanish. These tests, viewed against each other and against class performance, produced some interesting results.

What effect did teacher experience and preparation have on class performance?

When we set class averages against the scale of teacher experience and preparation, these were the results:



Fifth Grade Listening Comprehension (50-item test)

Sixth Grade Listening Comprehension (50-item test)

Sixth Grade Reading and Writing (50-item test)*

Teacher Preparation and Experience

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*See next page.

These scores represent three entirely different performance tests, and the grades should not be compared from test to test. The valid comparison is, within each test, between the teachers who bring different levels of preparation and experience to the task of teaching. And here the results are very dramatic. In each case, pupils whose teachers are in the high range of preparation and experience score significantly above those of pupils whose teachers are in the middle range, who in turn score significantly above those of pupils whose teachers are in the low range.[**] This holds true for the fifth grade and the sixth grade, for listening comprehension as well as reading and writing.

This raises two questions for a school system which, like Denver, is introducing a subject that many elementary schoolteachers are not well prepared to teach. Are there any combinations of activities and practice methods which will help to even out class learning despite differences in teacher preparation? And, second, can a television-centered course like this one be used to raise the average level of teacher competence? We shall present some evidence on each of these questions.

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[*] It must not be assumed that, because test scores are usually lower for reading and writing than for listening comprehension, that students were doing less well in the former skill. Whereas the listening comprehension test consisted of multiple-choice items, one third of which would have been expected to be answered correctly by chance, the reading and writing test required total recall and reproducing of information, with no correct answers expected by chance alone. The reading and writing tests were thus consistently more difficult.

[**] In each one of the tests, the differences between class performance on low and middle, and middle and high, were significant beyond the .05 level.

Are there any activities or combinations of activities that help compensate for less preparation and experience on the part of teachers?

Early in our research, it became clear that different elements of the learning context are more effective than others at different levels of teacher preparation and experience. For one example out of many, let us take the fifth-grade results on listening comprehension. Here, in the second year of the research, we tried supplementing the televised lesson with four different experimental treatments. One was 15 minutes a day of classroom drill conducted by the teacher. Another was the same amount of time divided between teacher drill and pupil practice with electronic aids -- record players or tape recorders. A third treatment was the teacher drill supplemented by a second viewing of the television in the evening; this, of course, took more time than the first two treatments. A fourth was both teacher drill and electronic aids in the classroom quarter-hour supplemented by a second viewing of the televised lesson, These treatments achieved quite different results under teachers who were differently prepared, as the following figure shows (see page 50).

This is a most revealing chart.* The best prepared, most experienced teachers do best with classroom drill alone; to take away part of the drill time for practice with electronic aids (as in the second treatment) takes away some of the effectiveness. The middle-

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*For more detail, see Table 11.

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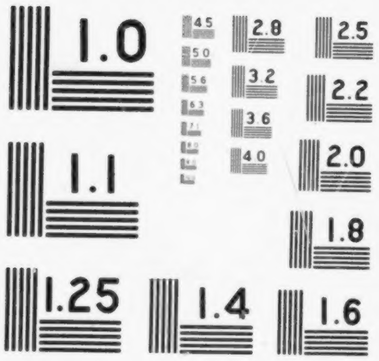
1.0
4.5
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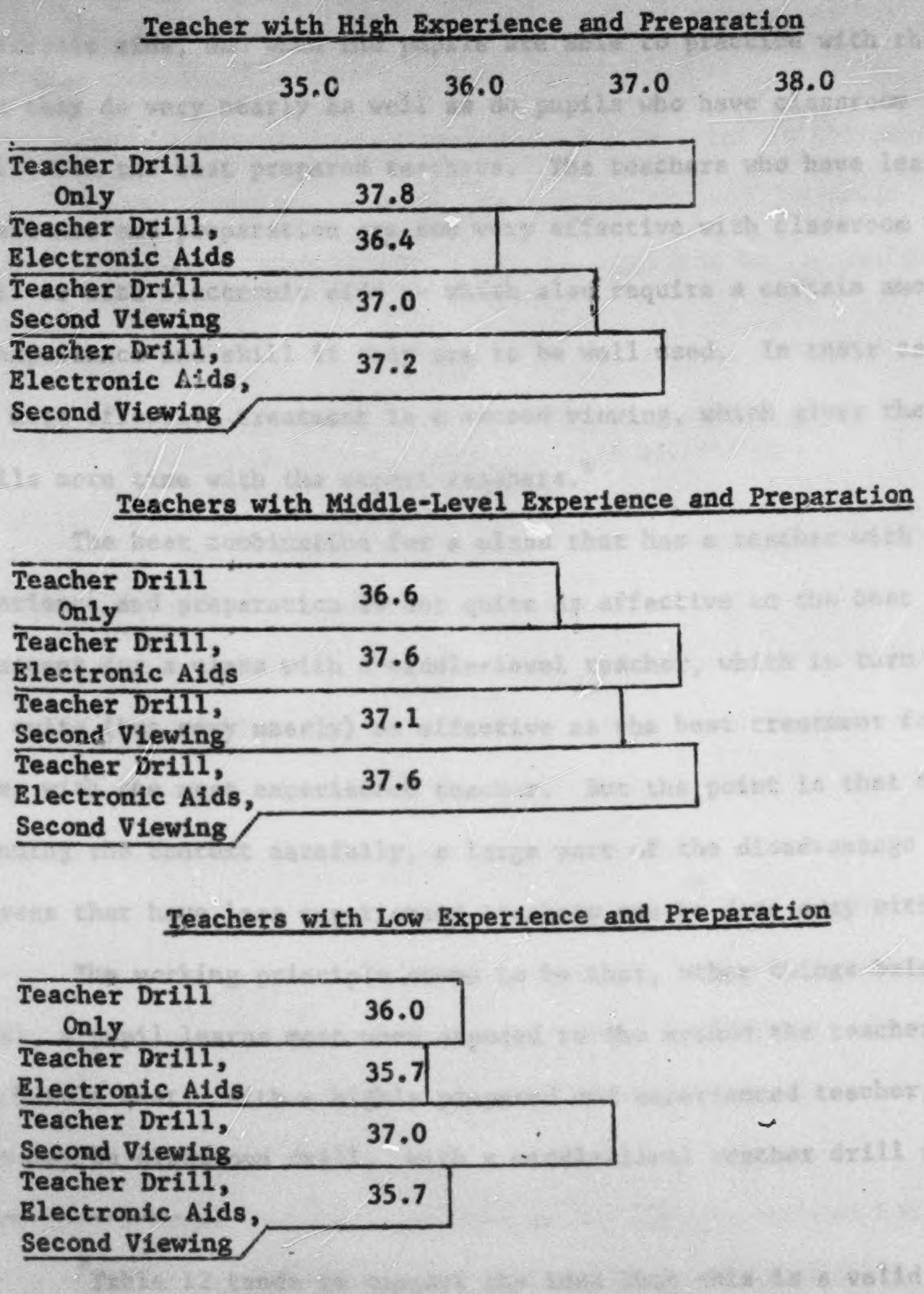
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963



(50-item test of listening comprehension) level teachers, on the other hand, do less well with their own classroom drill. In their classes it helps to give part of the time to electronic aids, and when the pupils are able to practice with these aids they do very nearly as well as do pupils who have classroom drill with the best prepared teachers. The teachers who have least experience and preparation are not very effective with classroom drill or with electronic aids -- which also require a certain amount of experience and skill if they are to be well used. In their case, the most effective treatment is a second viewing, which gives the pupils more time with the expert teachers.*

The best combination for a class that has a teacher with low experience and preparation is not quite as effective as the best treatment for a class with a middle-level teacher, which in turn is not quite (but very nearly) as effective as the best treatment for a class with the most experienced teacher. But the point is that by planning the context carefully, a large part of the disadvantage of classes that have less experienced teachers can be done away with.

The working principle seems to be that, other things being equal, a pupil learns most when exposed to the method the teacher can handle best. With a highly prepared and experienced teacher, this may be classroom drill. With a middle-level teacher drill is less effective and electronic aids more. With an inexperienced teacher, neither the drill nor the aids are handled expertly, and the most useful thing is to let the pupil watch an expert teacher a second time on television.

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*Table 12 tends to support the idea that this is a valid interpretation. The table shows a much higher correlation between the listening comprehension scores and number of repeat lessons viewed in the evening, on the part of pupils with teachers in the low preparation group, than on the part of pupils with more experienced teachers.

2

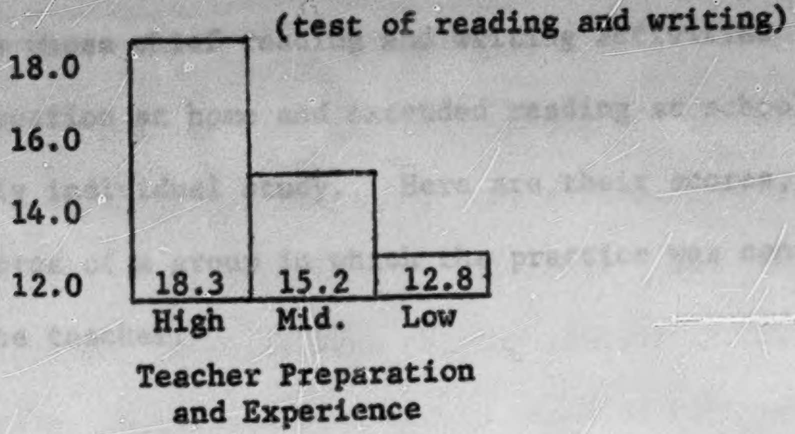
There are numerous other examples of this point in the pages that follow, and therefore we shall not belabor it here. However, there is an important note to add, which is suggested by the following question.

Does the effect of teacher preparation and experience extend to the learning activities the student undertakes by himself?

We were not surprised that the level of a teacher's preparation was reflected in such activities as classroom audio-lingual practice which the teacher himself handles. We were surprised, however, at how much effect the teacher's preparation and experience seems to have on individual practice activities.

An example of this is programmed instruction. This is an activity in which the program, in a sense, acts the part of the teacher. The pupil responds to the items in his programmed textbook as he might to the classroom questions asked by the teacher. Every effort is made to construct the program so that it will be "self-teaching".

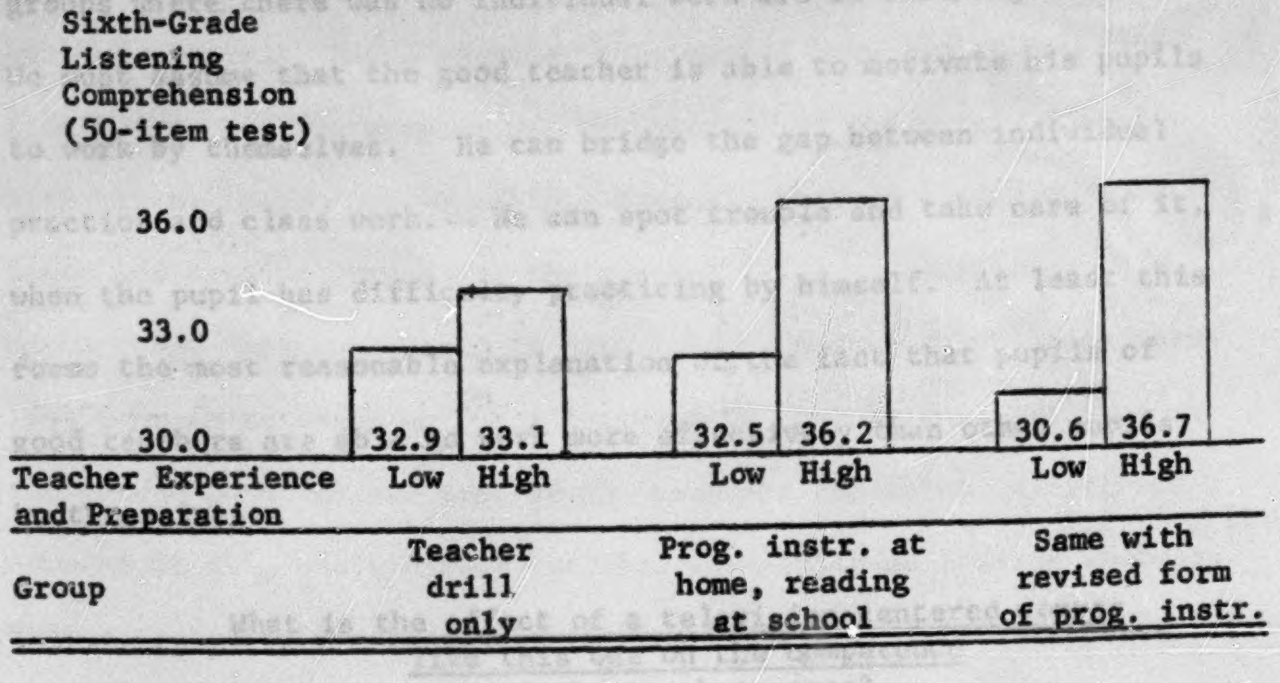
But here is what we found when we set the preparation and experience of the classroom teacher against pupil performance on programmed instruction in the second semester of the second year of research:

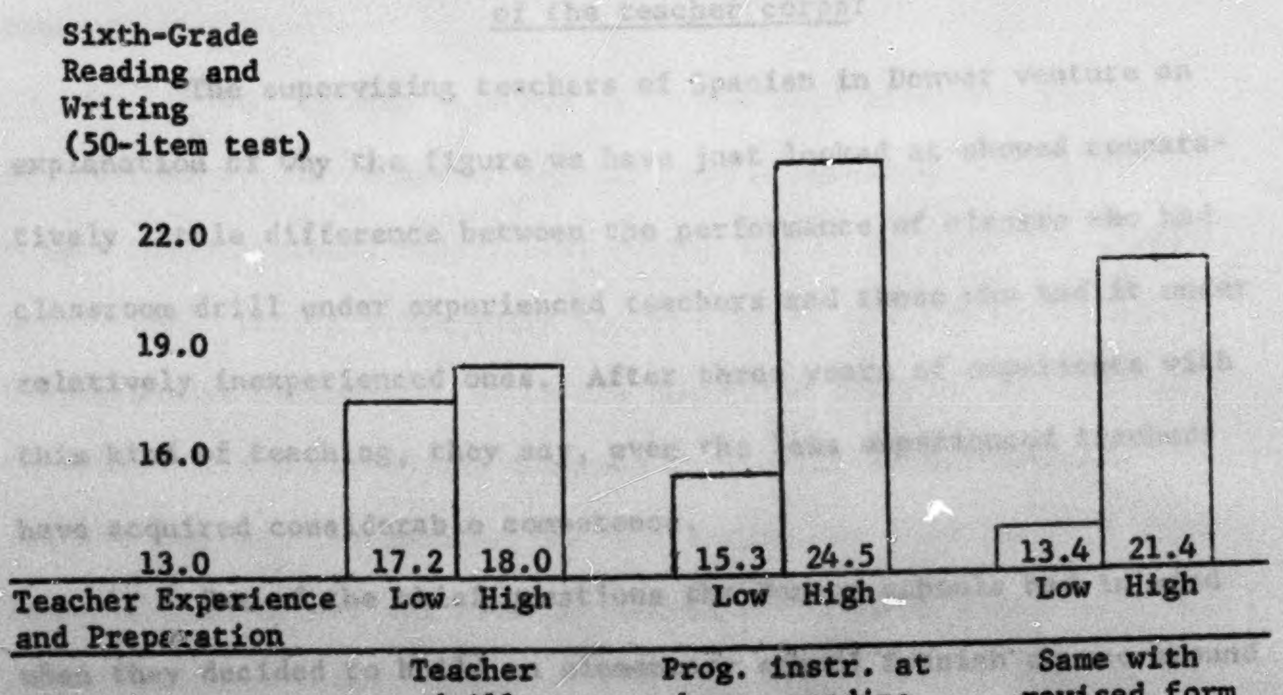


In other words, the teacher's preparation was reflected also in "self-teaching" work. As will be explained later, we found programmed instruction much less effective when started in the first semester, apparently because the pupils were not ready to study reading and writing independently. In the first semester, there was the expected curve -- classes with teachers high on the preparation and experience scale doing best, middle- and lower-scale positions doing less well -- but the differences were not large. In the second semester, however, when the students were "ready" for the program, the differences were highly significant. Why should this be? It must be that a superior teacher is able to transfer some of his own enthusiasm and drive to his pupils, and this is even more necessary when the student works by himself than when he practices orally in a class.

Support for this explanation is found in some of the comparisons from the third-year studies, which are detailed in Tables 30 and 33. Out of a considerable number of such comparisons, there were two experimental groups in which the advantage of high teacher preparation and experience was notably greater than the others.

These were the groups whose chief reading and writing activities were programmed instruction at home and extended reading at school -- in other words, mostly individual study. Here are their scores, compared with the scores of a group in which the practice was conducted entirely by the teacher:





These differences, in the latter two groups, where most of the work was individual, were very substantial indeed. In the reading and writing test, a highly experienced teacher was able to increase the average class performance by more than 50 per cent. The small differences that experienced teachers were able to achieve in the groups where there was no individual work are in striking contrast. We must assume that the good teacher is able to motivate his pupils to work by themselves. He can bridge the gap between individual practice and class work. He can spot trouble and take care of it, when the pupil has difficulty practicing by himself. At least this seems the most reasonable explanation of the fact that pupils of good teachers are able to work more effectively than other pupils by themselves.

What is the effect of a television-centered course like this one on the competence of the teacher corps?

The supervising teachers of Spanish in Denver venture an explanation of why the figure we have just looked at showed comparatively little difference between the performance of classes who had classroom drill under experienced teachers and those who had it under relatively inexperienced ones. After three years of experience with this kind of teaching, they say, even the less experienced teachers have acquired considerable competence.

One of the chief questions the Denver schools had in mind when they decided to build an elementary school Spanish course around television was: to what extent would it contribute to teacher in-service training in Spanish? Of 320 teachers assigned to fifth- and sixth-grade Spanish, only 6 had majored in Spanish in college; 14 had minored in Spanish. Only 115 (36 per cent) had taken any Spanish at all in college, and the amount they took ranged from one semester to four years. Only 137 (43 per cent) had any high school Spanish on their records; these records, too, ranged from one semester to four years, but the average was two years. Of the total, 32 had high school French and 45 college French. There are some duplications between the French and the Spanish lists. Considering the numbers who took some Latin in high school, and those who took other languages in college, our best estimate is that at the beginning of the course about 25 per cent of the teachers had taken no language courses at all, and a little over half had taken no Spanish courses. What happened to these teachers during the first years of the new course?

Some concrete evidence as to how this situation improved is provided by the record of teachers who attended workshops or sought other training experiences during the first three years of the course. During those years 151 studied in the University of Denver summer workshop -- 87 in the summer of 1960, 39 in 1961, 25 in 1962. This workshop was designed to provide some elementary Spanish language instruction, to familiarize the teachers with the audio-lingual method and with the latest doctrine on elementary school language teaching, and to let them practice with some of the materials and methods of elementary school language teaching. In addition to these, 23 teachers participated in summer National Defense Act Institutes at seven different colleges and universities. These NDEA institutes were more advanced than, but generally parallel to, the University of Denver workshop. They also included instruction on modern life and ideas in Spanish-speaking countries. During these years, four teachers studied Spanish at the University of Colorado extension school; three attended summer school in Mexico, one in Panama; five traveled in Mexico, and one in Spain. Thus about half the teachers, during the first three years of the new course, had some additional instruction or experience in the language.

The Denver Schools themselves conducted inservice Spanish training for the teachers, designed both to improve general proficiency and to make sure that the assigned procedures were being followed properly in the research groups. In 1960-61, there were two city-wide meetings, two area meetings (for parts of the city), and two televised sessions. The next year there were two city-wide meetings, eight area meetings, and one televised session for fifth- and one for sixth-grade teachers. In 1962-63 there was one city-wide meeting for sixth-grade teachers, seven area meetings for fifth-grade teachers, and one special meeting for teachers who had access to dual-channel tape recorders.

Recognizing the value of all this inservice training, still the supervising teachers are inclined to believe that one of the most effective learning experiences available to teachers during the first years of the course was the television itself. For two or three periods a week they watched, with their classes, an expert speaking Spanish, doing many of the things they too were expected to do in their classrooms. Along with their students, they learned to respond to the television teacher, and this helped break down their self-consciousness at speaking. From listening to the television they learned the rhythms and some of the intonations of the language. In other words, they, like their pupils, experienced some of the benefits of audio-lingual teaching.

The supervisors describe what happened to the teachers during the first years of the new course as a steady growth in confidence. At first they were reluctant to speak the language, and most loath to be observed while teaching it. Frequently the research personnel found themselves unwelcome in classrooms during Spanish practice periods, and indeed the impression was sometimes conveyed to administrators that they, too, were not welcome as observers. According to the supervisors, there has been a striking change in these attitudes. Teachers who were afraid to speak the language are now actually talking in it -- not parroting the drill book, but really using the language, taking the lead in an active dialogue practice. At first, they report, 15 minutes of classroom practice seemed like an eternity; now it seems entirely inadequate for the practice they want to give their pupils. And they no longer try to keep the principal from coming in to observe the Spanish class.

Interest built up, along with confidence. Teachers began to initiate inservice training plans. Some asked the supervising teachers to come and discuss some of the problems of Spanish teaching. Others arranged area meetings for the same purpose. Some made good use of the dual-channel tape recorders to improve their own pronunciation. Some traveled to Spanish-speaking countries so that they could tell their classes something about the culture as well as the language. As the teachers became more interested, observers say they sensed a rise in interest in pupils and parents also.

Thus, by all the evidence we have -- the amount of formal training at workshops, institutes, and meetings; the reports of the supervising teachers as to what went on in the classroom; and our own observation -- we conclude that this course was a powerful device for inservice training, and that a television-centered course can potentially accomplish the same kind of thing anywhere a school system is as anxious to have it happen as Denver was.

What effect does teacher interest have on class performance?

The first thing we found out, in working with the teacher interest scale developed by the Educational Testing Service, was that there is no meaningful correlation between it and the scale of preparation and experience.* That is, a better trained teacher, a teacher with more experience, is not necessarily a more interested teacher. Any apparent relationship between amount of preparation and level of interest is likely to be there by chance.

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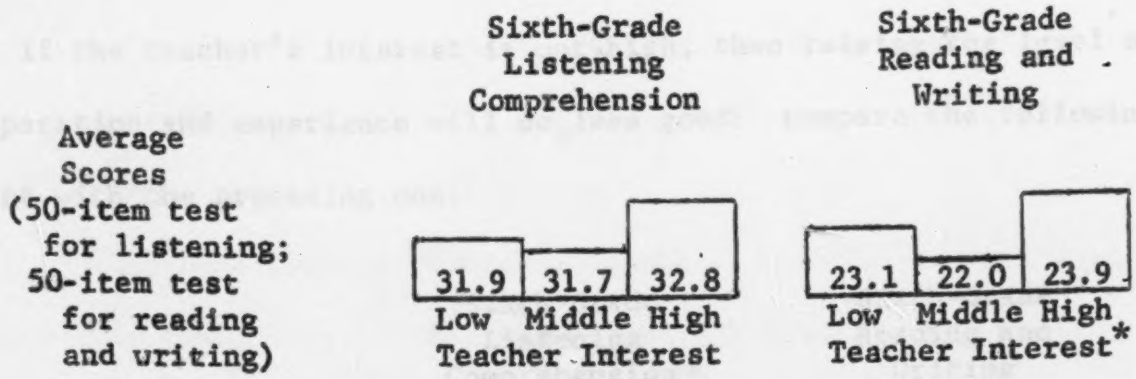
*See Table 40. For an interim description of the ETS scales, and that organization's findings concerning them, see the paper, "Evaluating a Program: Some Recommendations and Results," by Milton H. Maier and Paul I. Jacobs, presented at the 48th annual convention of the National Association of Secondary School Principals, Chicago, February, 1964. A complete report on the scales will be published by ETS.

We found, in the second place, that teacher interest is related in a statistically significant way to class performance, although the differences are not very large. This illustrates the general magnitude of the effect:



Thus the teacher's interest is not reflected quite so strongly in pupil performance as is preparation and experience.

But if we look at the interaction of teacher interest and preparation and class performance, then we find some very interesting things. For if interest is high, then growing experience and preparation will steadily increase the teacher's effectiveness as measured in class performance:

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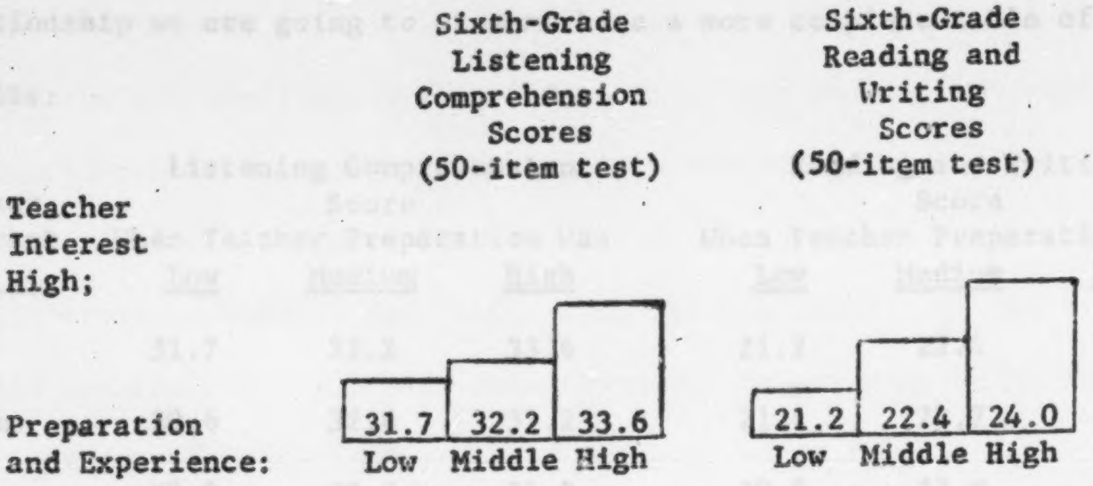
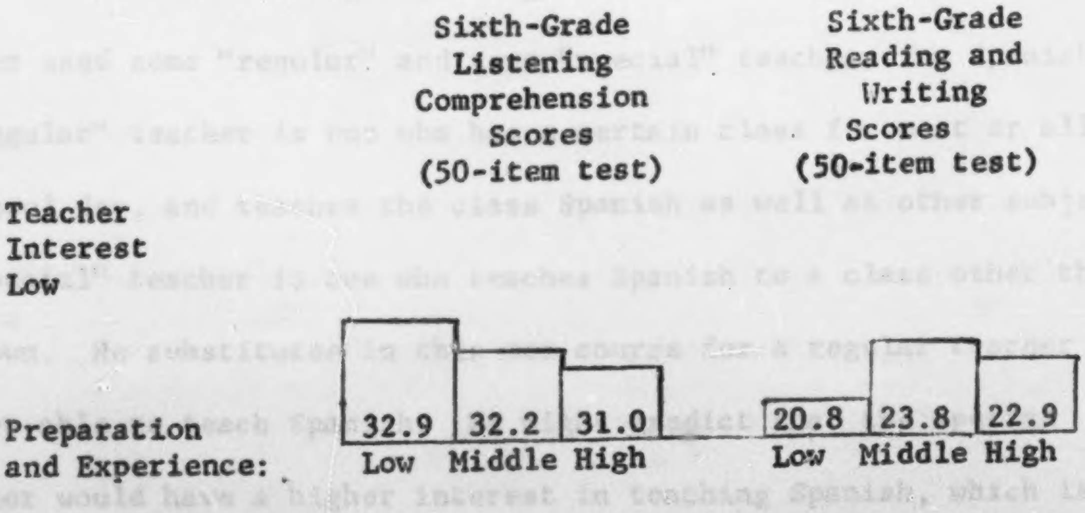
*Table 39.



But if the teacher's interest is not high, then raising the level of preparation and experience will do less good: Compare the following chart with the preceding one.



The optimum combination, of course, is to have both interest and preparation high. Then we get results like the third columns in each of these last figures.* Because of the importance of this relationship we are going to present here a more complete table of results:

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*Details in Table 41.

When Teacher Interest Was	Listening Comprehension Score When Teacher Preparation Was			Reading and Writing Score When Teacher Preparation Was		
	Low	Medium	High	Low	Medium	High
High	31.7	32.2	33.6	21.2	22.4	24.0
Medium	30.6	32.6	31.2	21.4	22.7	21.3
Low	32.9	32.2	31.0	20.8	23.8	22.9

It is striking to observe that some of the poorest performances were given by the pupils of teachers who were high in preparation and experience, but low in interest.

Another finding regarding teacher interest is worth noting. Denver used some "regular" and some "special" teachers for Spanish. A "regular" teacher is one who has a certain class for most or all of a school day, and teaches the class Spanish as well as other subjects. A "special" teacher is one who teaches Spanish to a class other than his own. He substitutes in this one course for a regular teacher who is not able to teach Spanish. We might predict that the special teacher would have a higher interest in teaching Spanish, which is his specialty, and this is what we find. The average interest level of special teachers is significantly higher (at the .02 level) than the average of regular teachers.

Does this mean that classes will learn more from a special teacher than from a regular one? Not necessarily. There are some unknowns in the equation. If the special teacher is more experienced and better trained, as well as more interested, we have seen that the chances are his classes will learn more. But the regular teacher has two advantages: he gets to know his pupils well, and he sees them at other times of the day. Many regular teachers use situations in other courses as excuses for introducing Spanish drill. If the teacher has the class all day, then there may be an opportunity for more practice with the tape recorder or more use of the Spanish corner or the Spanish reading material. Thus there are potential advantages on each side, and we actually find (Table 25) that there is no significant difference between the average performance of classes taught by regular and by special teachers.

What is the relation of teacher interest to pupil interest?

Both teacher interest and pupil interest were highly significant as sources of variation in the language skills tests. Pupil *interest seemed to* produce a somewhat larger effect, as would be expected, but the best results usually occurred when both teacher and pupil interest was high. The following table shows how this worked:

When Pupil Interest Was	Listening Comprehension Score (6th grade) When Teacher Interest Was Low	Medium	High	Total	Reading and Writing Score (6th grade) When Teacher Interest Was Low	Medium	High	Total
High	33.0	32.8	33.2	32.9	23.5	22.4	25.6	23.7
Medium	32.2	32.1	33.4	32.5	24.5	23.6	24.7	24.2
Low	30.8	30.4	31.6	30.8	20.9	19.6	20.4	20.4
Total	31.9	31.7	32.8	32.1	23.1	22.0	23.9	22.9

But let us ask, what seems to predict pupil interest? Teacher interest was not significantly related to it, and neither were teacher experience and preparation, or parent participation, although the latter two came near being statistically significant. By far the best predictor was the pretest of interest given pupils at the beginning of the year. This is not surprising, of course, inasmuch as the pupils being tested had already had a year of Spanish, which gave them ample opportunity to make up their minds whether they were interested in the course. If they were, their interest was likely to continue through the second year. The great determiner thus seemed to be the pupils' experience in fifth-grade Spanish. The way the subject was taught, and very probably the attitude of the fifth-grade teacher toward the subject, were doubtless reflected in the pupils' interest levels at the beginning of the sixth grade.

SUMMING UP

In summary, then, we can say that the classroom teacher is undoubtedly the most powerful and effective element in the context we can provide for the instructional television.

Especially impressive is the effect of teacher preparation and experience on pupils' performance. This effect extends even to the quality of work done individually by pupils -- in fact, as we shall see later, is especially evident there. Thus it is foreseeable, and we shall be able to confirm in the next chapter, that the most effective classroom combinations will be those that include a skilled teacher and the most productive kinds of individual practice.

In general, however, the best context, in the audio-lingual year at least, seems to make maximum use of the teacher doing what he can do best. For example, a highly skilled and experienced teacher will teach his class most if a maximum part of class time is devoted to teacher-directed drill. An inexperienced teacher, who is able neither to conduct drill nor to supervise the use of electronic aids very skillfully, can do a service to his class by assigning them to view a repeat of the televised lesson (where they have more time with an expert teacher). A teacher who is on the middle level of preparation and experience, not at his best in conducting drill but able to supervise pupils skillfully when they practice with electronic aids, will get maximum help from electronic aids.

One of the most important findings is that one effect of a television-centered course like this one is to raise very quickly the average competence, in the subject, of the teacher corps. This is seen in a rapid rise in confidence among the teachers, in their seeking additional study and inservice training, and in the reports of supervisors about increasing skill in classroom practice.

Teacher interest, as well as teacher preparation and experience, is related positively to class performance. Most significant is the interaction of interest with preparation and experience. If a teacher's interest is not high, then raising the level of his preparation will not be strongly reflected in the performance of his pupils. Some of the poorest results came from classes where preparation was high and interest low. In this connection, it was noted that special teachers of Spanish (those who have the class only for the Spanish period) typically have a very high interest in Spanish, and this doubtless helps to compensate for their lack of contact with and knowledge of their students. Over-all, we found special teachers got about as much performance out of their students as did regular teachers who were prepared to teach Spanish.

Pupil interest was not related significantly to teacher interest, although it came close to being significantly related to teacher preparation and experience. The best predictor of student interest in the sixth grade was the pre-term test of student interest, which may well have reflected the interest and skill of the fifth-grade teacher.

5. THE CLASSROOM EXPERIENCE

Granted the enormous potency of the classroom teacher as an ally of instructional television, the question then arises: what can that teacher best do? What context of study and practice can he most effectively build around the television in the classroom? What methods, materials, and devices can he use to make the classroom experiences most effective?

Let us recall the possibilities. In the period of audio-lingual teaching, when written materials were not permissible, the basic classroom context was necessarily oral practice of the language. The most usual form of this is drill conducted by the teacher. But there are several kinds of teacher-directed drill, some of which might prove to be more effective than others as an adjunct to the instructional television. Furthermore, there are certain electronic aids which, under appropriate circumstances, might supplement or even substitute for the oral practice conducted by the teacher. These electronic devices -- record players, single and dual-channel tape recorders -- are presumably of different effectiveness, and differentially useful under different situations. In addition to these, there are a number of devices to encourage the pupils to speak the language to each other. Among these are Spanish tables at lunch, Spanish conversations over toy telephones, Spanish plays and programs, and the like. Although we tested the teacher drill and electronic aids quite systematically, we have no evidence on the informal methods of encouraging pupils to teach each other, except the special experiment to be described in Chapter 7.

When the study of reading and writing was added to audio-lingual study of the language -- and it was a research question when the study of reading and writing should start -- then the possibilities were considerably enlarged. Teacher-directed drill and all the electronic aids were still available, but in addition there was the possibility of reading assignments; there was a workbook prepared specially for the course; and there was programmed instruction. In each of these cases, there was the possibility of doing the work (extended reading, programmed instruction, and so forth) at school or as homework. Two forms of the programmed instruction were available to test against each other, and there was also the possibility of presenting these materials, not as a programmed text but in a teaching machine. Still another possibility tried in a number of schools was a "Spanish corner" of the classroom, in which pupils could spend some time with Spanish reading materials, recordings, pictures, artifacts, and the like. Considering the possible interactions of these treatments with teachers' preparation and pupils' ability, it is obvious that there are a very large number of potential combinations to test.

We proceeded to test as many as possible of them, beginning with the simpler comparisons, and selecting out the most promising treatments for larger combinations.

TEACHER-DIRECTED PRACTICE

What type of teacher-directed drill is most effective as a classroom adjunct to the televised lesson?

Three kinds of teacher-directed drill were tried in combination with the televised lesson. These are describable as follows:

A dialogue drill consists of a short, meaningful conversation between two people. The pupil learns the part of one person in the conversation with the teacher taking the other part. Then the roles are reversed, with the pupil taking the other part. Finally, two pupils use the drill to converse. Dialogue practice is said to be valuable in language learning because:

> It involves a natural and exclusive use of the audio-lingual skills. . . . All that is learned is meaningful, and what is learned in one part of a dialogue often makes meaning clear in another. From the start the student learns to address people directly and to use the first person singular -- items of basic importance in communication. If the materials are appropriate, the learner finds a personal interest in what he is saying and a possible use far beyond the classroom for the expressions which he masters.*

Structure drill involves repetition of a language pattern with small and consistent changes at each repetition. The pattern usually consists of a single sentence, and any word or phrase in the sentence may be changed. The following is an example in English with the verb varied: I see an apple; I buy an apple; I eat an apple;

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*Brooks, Nelson. Language and Language Learning. New York: Harcourt, Brace and Company, 1960. p. 141.

I like an apple; etc. Structure practice, as opposed to dialogue, is not what would be likely to occur in ordinary conversation.

> It is to communication what playing scales and arpeggios is to music: exercise in structural dexterity undertaken solely for the sake of practice, in order that performance may become habitual and automatic -- as it must be when the mind concentrates on the message rather than on the phenomena that convey it. Structure practice capitalizes on the mind's capacity to perceive identity of structure where there is a difference in content, and its quickness to learn by analogy.*

Eclectic drill combines dialogue and structure drill with such other practice as narratives, songs, and games. Eclectic drill is common practice in classrooms that do not have the aid of television. It was felt, however, that inasmuch as television would provide some of the experiences given a non-television class by eclectic drill, it would be desirable to test dialogue and structure drill by themselves in comparison with eclectic.

In general, the eclectic form resulted in the most learning and the dialogue in the least learning, but the differences were not statistically significant except on the first semester final examination, where the eclectic form proved to be significantly more effective than the dialogue:

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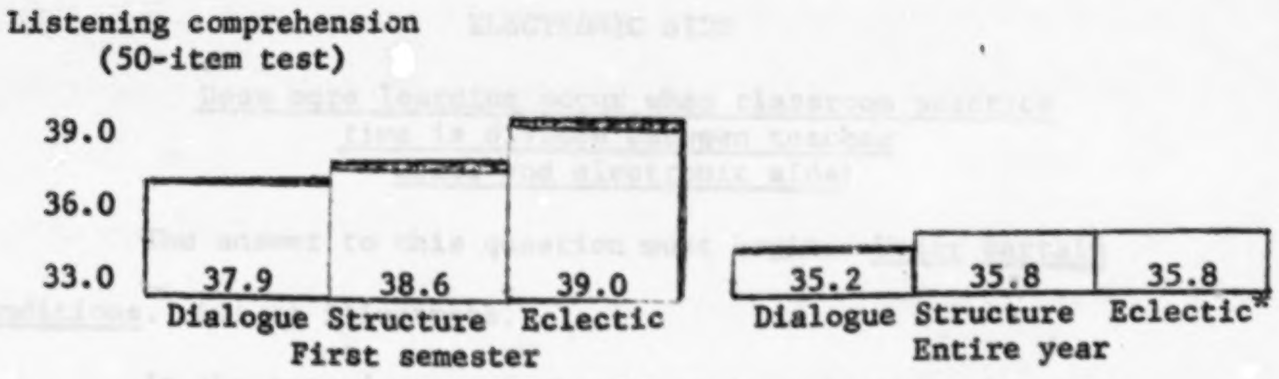
*Brooks, op. cit., p. 142.



The fact that dialogue practice came off worst may be a comment on the teachers rather than the method. To produce and guide good dialogue requires a conversational command of the language; the other forms do not require this. The less well-prepared teachers undoubtedly had the most difficulty with the dialogue method. Inasmuch as these tests occurred in the first year of the study, the average level of teacher preparation was at its lowest. Therefore, because the eclectic method permits the teacher to do the things he does best, it is generally preferred by the teacher. And as his competence with the language increases, he is likely to include a larger component of dialogue practice.

Our conclusion was that the eclectic method is at least as good as the other methods, and, in the absence of highly trained teachers, probably better than at least one of them. Since it was also the method the teachers preferred, it was accepted for classroom use during the remainder of the research.

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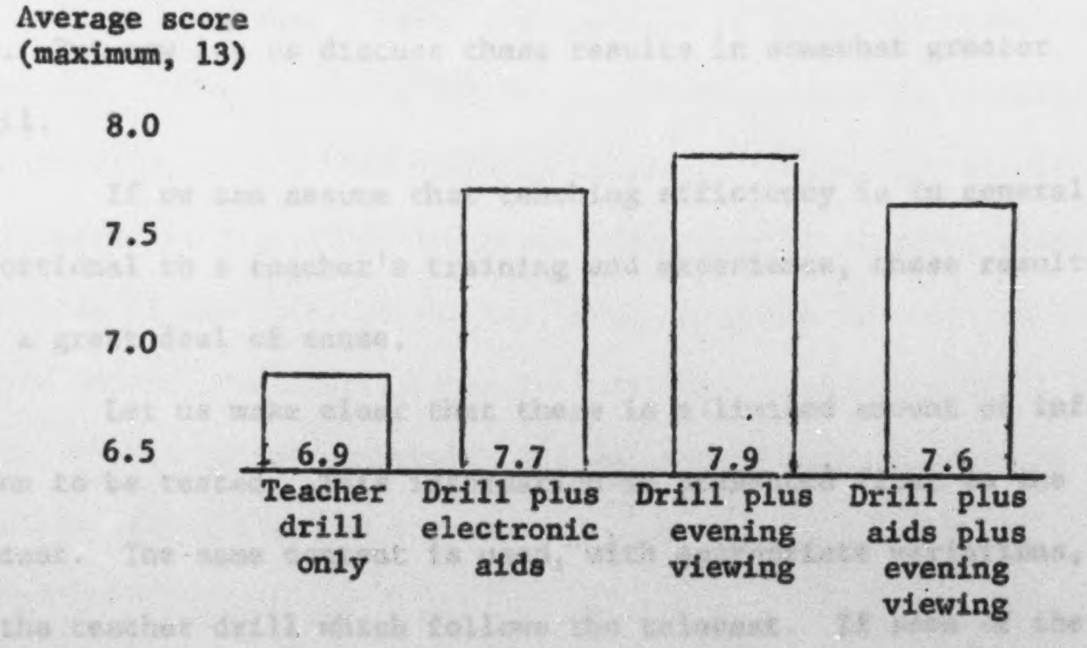
*The first and second semester examinations were entirely different, with different norms. Therefore, the fact that mean scores are lower at the end of the year does not mean that the students knew less at that time than at the end of the first semester.

ELECTRONIC AIDS

Does more learning occur when classroom practice time is divided between teacher drill and electronic aids?

The answer to this question must begin: Under certain conditions. Let us illustrate.

In the second year of the research we tested eclectic drill alone versus drill plus electronic aids, drill plus a second viewing of the television, and drill plus both aids and second viewing. At the end of the first semester we found no significant differences in the performance of any of these groups, on the test of listening comprehension. The pupils who used electronic aids scored, on the average, a bit higher, but the differences were such as could easily have occurred by chance. In the speaking tests, however, there was a significant difference:



Teacher drill plus evening viewing was significantly superior to drill alone (.05); and the combination of drill plus electronic aids was on the verge of being significantly superior to drill alone (.06). Details are in Table 10e.

It was not entirely surprising that addition of a second television viewing to classroom drill might produce more learning, because that, in effect, means adding 15 minutes instruction time. But the results also suggest that, under some conditions, it might be helpful to divide the classroom time between teacher drill and electronic aids. In the following semesters, therefore, we tried to find out what some of these conditions might be.

Does teacher experience and preparation make any difference in the relative effectiveness of electronic aids?

We have already said (see the table on page 50) that it does. But now let us discuss these results in somewhat greater detail.

If we can assume that teaching efficiency is in general proportional to a teacher's training and experience, these results make a great deal of sense.

Let us make clear that there is a limited amount of information to be tested. This information is presented first in the telecast. The same content is used, with appropriate variations, for the teacher drill which follows the telecast. If some of the class time is used for practice with electronic aids, this experience again rehearses the same information. And if the telecast is viewed a second time, in the evening, this amounts to a direct repetition of the original information. Therefore, we are really comparing amounts and kinds of repetition. A second viewing of the telecast amounts to adding 15 minutes of repetition without variation. Either teacher drill or practice with electronic aids is repetition with variation.

From previous experiments we should expect repetition with variation to be more effective than repetition unvaried, other things being equal.* Other things being equal, we should also expect more repetition to be more effective. And we should expect a skilled teacher to be more effective than a less skilled teacher in the learning activities he himself is in charge of.

If a teacher is well prepared and highly skilled, his pupils learn most when a maximum proportion of their classroom time is devoted to the teacher's own drill. (This applies to listening comprehension, rather than speaking ability. Apparently, electronic aids contribute significantly to the efficiency of speaking practice, regardless of the skill of the teacher.) Inasmuch as there is a limited amount of material to be learned, the teacher can drill the pupils on this quite completely, and apparently nothing is to be gained by adding a second viewing.

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*For example, see Carpenter, C. R. "Psychological Concepts and Audio-Visual Instruction." Audio-Visual Communication Review, 5:361-69, 1957. Also, Allen, William H. "Audio-visual Communication." Encyclopedia of Educational Research. (Edited by Chester W. Harris) New York: Macmillan, 1960, pp. 115-37.

On the other hand, suppose that a teacher is in the middle range of preparation and experience. Then there is something clearly to be gained in listening comprehension as well as speaking, by letting the electronic aids carry some of the classroom drill. The teacher is not so skilled that the pupils stand to lose when electronic aids are substituted for any of the teacher's own time, and on the other hand the teacher is skilled enough that he can supervise the use of electronic aids.

Up to this point we have been talking about teachers skilled enough to conduct or supervise effective classroom practice. The repetition with variation that goes on in the classroom is sufficient to teach the material, and there is little to be gained by adding an extra period of unvaried repetition. But what happens when the teacher is relatively inexperienced? In this case, there is nothing to be gained (and very little to be lost) by taking some of the teacher's drill time for electronics. But there is considerable to be gained by giving the pupil another 15 minutes of exposure to the skilled television teacher.

To put it simply, experiences that bring repetition with variation are relatively more effective the more highly skilled the person is who is in charge of them. Experiences that bring unvaried repetition are relatively more effective as the experiences involving repetition with variation become less efficient. These conclusions make good practical, as well as theoretical, sense.

The conclusions are supported further by the fact that there was a much higher correlation between listening comprehension score and number of programs viewed in the evening for pupils whose teachers were in the low bracket of training and experience, than for pupils with better prepared and more experienced teachers (Table 12). Apparently, these pupils with less experienced teachers really needed and benefited from the second viewing.*

Confirmation for these results was found also in the sixth grade where, in general, electronic aids were not found maximally successful in the hands of either the very experienced or the very inexperienced teacher (Table 22). There is evidence also in the sixth-grade results that additional experience helps a relatively inexperienced teacher to make better use of electronic aids. During the first semester, many of the teachers with low training and experience were not required to teach reading and writing, and thus had more practice with audio-lingual teaching. During this semester, electronic aids were actually a detriment to the performance of these teachers. But in the second semester, thanks to the additional practice, these teachers could use electronic aids much more effectively. Their students got more out of the electronic aids than did students whose teachers were on the same level of preparation but had not had the previous semester to concentrate on audio-lingual teaching.

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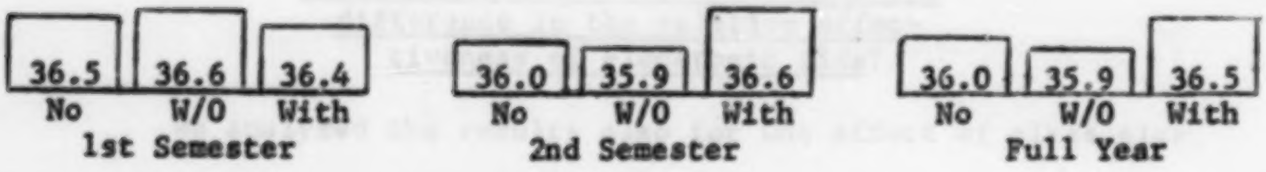
*Our guess as to why the pupils of less experienced teachers did not benefit particularly from the use of electronic aids, and especially as to why it did not help to combine electronic aids with a second viewing, is that the use of electronic aids under the supervision of inexperienced teachers is so inefficient that it tends to be counterproductive. With such students we found that the correlation between number of programs viewed in the evening, and listening comprehension score, was very low.

What is the relative effectiveness of electronic aids with and without feedback?

Are different kinds of electronic aids more effective than others when combined with teacher-directed drill? Specifically, are devices with feedback -- dual-channel tape recorders that let a student record his own speech and compare it with that of an expert -- are these more effective than record players or single-channel tape recorders that do not permit feedback?

As we shall see (Chapter 7), some teachers thought that their pupils learned a great deal more from dual-channel recorders. In the systematic tests of the third year, however, we found no significant difference between the performance of the main research groups with and without feedback either first semester, second semester, or for the full year (see Table 23). This was true on the tests of listening comprehension as well as those of speaking (see Table 26). There were differences, but they might have occurred by chance.

Bearing in mind, however, that these may be only chance differences, let us examine the means on the listening comprehension test, because they show a rather interesting trend.



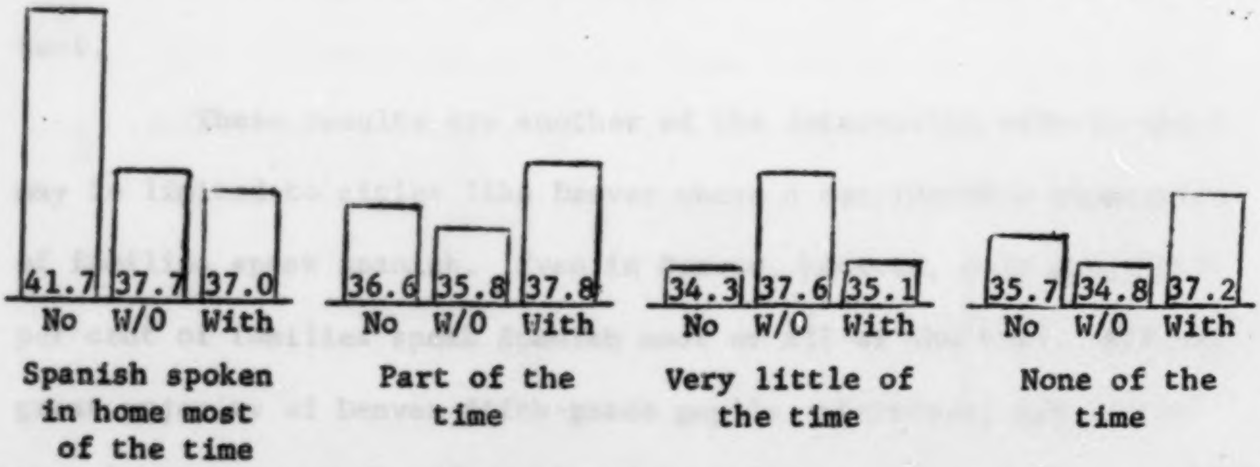
No = no electronic aids
W/O = electronic aids without feedback
With = electronic aids with feedback
(50-item test)

First semester grades, of course, should not be compared with second semester, because these were quite different tests. The comparisons to look at are those among the groups of three.

When one does that, it is evident that aids with feedback are more helpful after the first semester. The same thing shows up in the speaking test. Whereas this might have come about by chance, still the fact that it occurs in both listening and speaking tests gives a little more confidence in it. Is it that by second semester pupils are better able to practice by themselves and evaluate their own efforts? Or is it that teacher experience has something to do with the effectiveness of the different kinds of aids? The analysis failed to show a significant difference (see Table 24), related to teacher preparation, although the means show a clear trend in the direction of more experienced teachers getting considerably better results from the aids with feedback. Therefore, a possible explanation is that a certain level of training and skill on the part of the teacher is necessary before dual-channel tape recorders can be used at their full effectiveness for audio-lingual practice.

Does Spanish spoken at home make any difference in the relative effectiveness of electronic aids?

We analyzed the results also for the effect of class size, sex differences, the use of a special Spanish teacher as compared to the regular classroom teacher, and the amount of Spanish spoken in the home (Table 25). Of all these, only the amount of Spanish spoken in the home produced significant differences. And the results are quite interesting, as this figure shows:



No = no electronic aids
W/O = electronic aids without feedback
With = electronic aids with feedback

(50-item test)

It is clear that children from Spanish-speaking homes do better, in the first year of the language at least, without electronic aids. This is rather puzzling. Is it because the type and quality of the language spoken on the records and the tapes contrasts with the kind of Spanish they hear at home, and therefore confuses them? In any case, there seems to be an important interaction between the experience of speaking Spanish at home and practicing with electronic aids in the classroom. This undoubtedly helps to mask the over-all effect of these aids. But for pupils who do not speak Spanish most of the time at home (as the figure shows) there is an advantage in using some type of electronic aid; and for pupils who speak no Spanish at home, there is a significant advantage in using electronic aids with feedback.

The results of the speaking test (see Table 26) in general support the conclusions we have drawn from the listening comprehension test.

These results are another of the interesting effects which may be limited to cities like Denver where a considerable proportion of families speak Spanish. Even in Denver, however, only about 8.7 per cent of families speak Spanish most or all of the time. For the great majority of Denver fifth-grade pupils, therefore, and for an even larger proportion of pupils in most cities, there is good reason to believe that electronic aids, especially those with feedback, are a useful addition to classroom practice in the first year of audio-lingual Spanish.

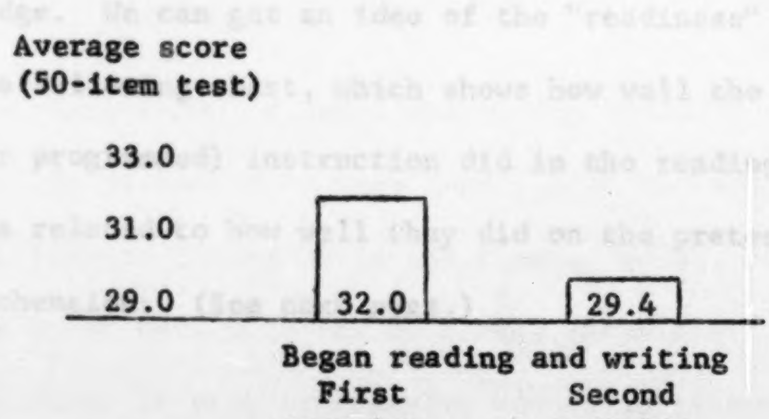
TIMING

When is a pupil in this course ready to begin reading and writing the language?

So far we have been talking about audio-lingual teaching and learning. How much of this must a student have before he is ready to begin the study of reading and writing the language?

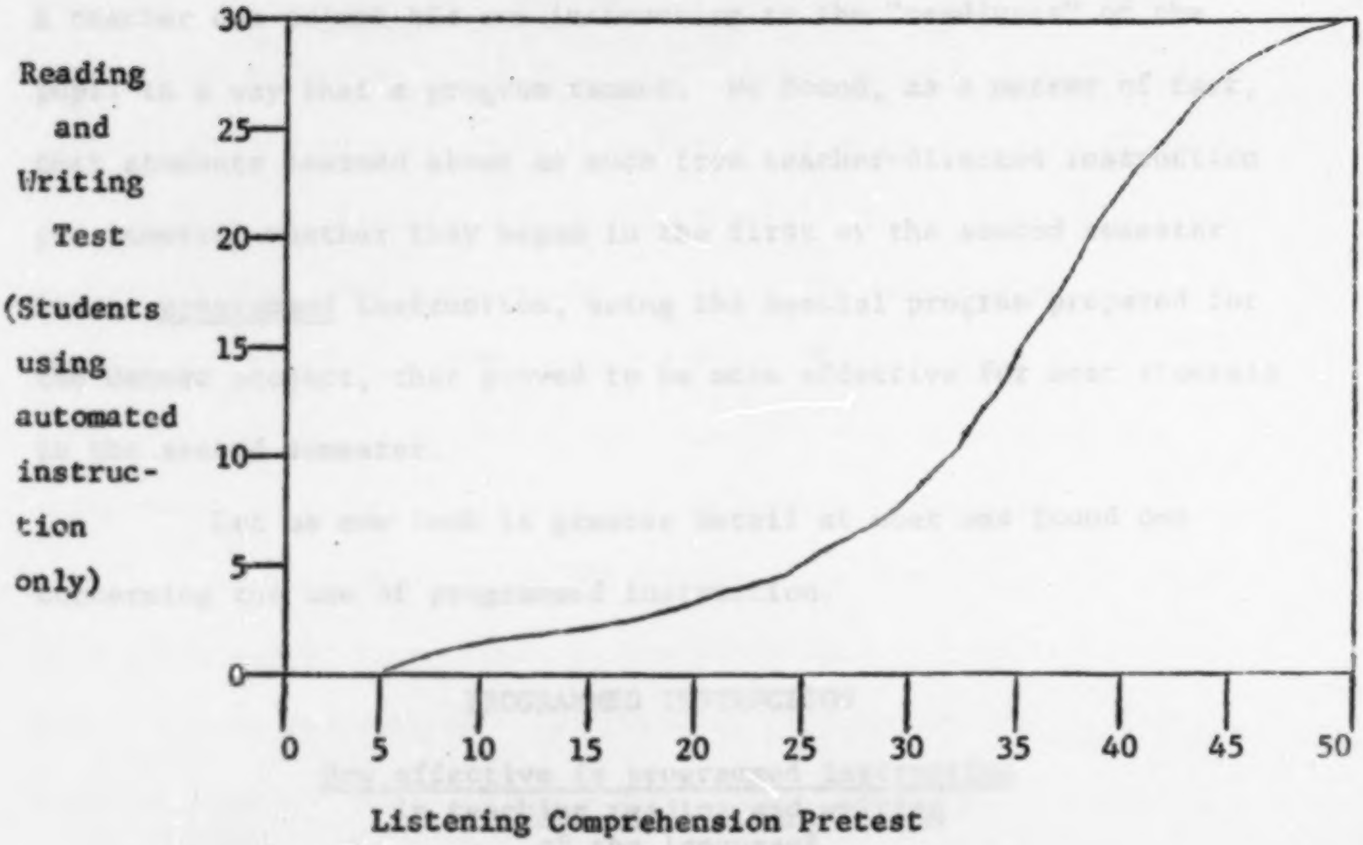
If beginning reading and writing earlier were to have a deleterious effect on pupils' performance in the course, we should expect this to show up in listening comprehension and especially speaking. Language experts agree that premature introduction of reading and writing will cause a pupil to anglicize his pronunciation. Furthermore, the additional practice on reading and writing would steal time from audio-lingual practice, and therefore the pupils would learn less about listening and speaking the language -- at least, that was what we thought might happen.

It did not. Students who began reading and writing in the first semester of the second year did significantly better, at the end of the year, in listening comprehension, as this chart shows:



The difference is a highly significant one. The end-of-year speaking tests of pupils who began reading and writing first semester were also superior to those of pupils who began second semester, but the difference is slight and it is difficult to make a fair comparison on the speaking tests because of other effects. At the least, though, we can say there is no evidence that beginning reading and writing early has a bad effect on pupils' ability to speak the language they were learning; and, if anything, it has a good effect on their ability to understand the spoken language.

We did find evidence that some pupils might be beginning automated instruction in reading and writing too early. Pupils did significantly better with the automated instruction in a single semester if they began it at the middle of the school year. There is apparently a certain point at which the pupil is sufficiently in command of the listening and speaking vocabulary to use efficiently a "self-teaching" method of learning to read and write the language. More precisely, there is a point when the pupil is ready to use most efficiently the program that we made, which assumes a certain amount of prior knowledge. We can get an idea of the "readiness" required by examining the following chart, which shows how well the students of automated (or programmed) instruction did in the reading and writing test, as related to how well they did on the pretest of listening comprehension: (See next page.)



As the chart shows, a pupil who scores below 25 in listening comprehension on the pretest does very poorly with the programmed text. Somewhere between 25 and 35 is the turning point, beyond which a pupil is ready to do well with the automated materials. Beyond that point, the pupil finds it easy to transfer his audio-lingual learning to self-study of reading and writing. And inasmuch as this point is most commonly reached after the beginning of the first semester, the Denver automated materials seem to be more effective with a majority of pupils if begun in the second semester.

Does this mean that a student who scores below a certain level in listening comprehension on the pretest should not start the study of reading and writing until a later semester? Not necessarily.

A teacher can adjust his own instruction to the "readiness" of the pupil in a way that a program cannot. We found, as a matter of fact, that students learned about as much from teacher-directed instruction per semester whether they began in the first or the second semester. It was programmed instruction, using the special program prepared for the Denver project, that proved to be more effective for most students in the second semester.

Let us now look in greater detail at what was found out concerning the use of programmed instruction.

PROGRAMMED INSTRUCTION

How effective is programmed instruction in teaching reading and writing of the language?

As we have suggested, a striking fact emerges from the data. There is a great deal of difference between the performance of pupils who studied programs in the first semester and those who studied programs the second semester. Those who began to use programs in the first semester did less well than those who were taught wholly by teacher-directed practice. For those who started second semester, the result was reversed; and those who studied their programs from teaching machines (which we shall talk about shortly) did particularly better than those who were taught by teacher drill. Details are in Table 19.

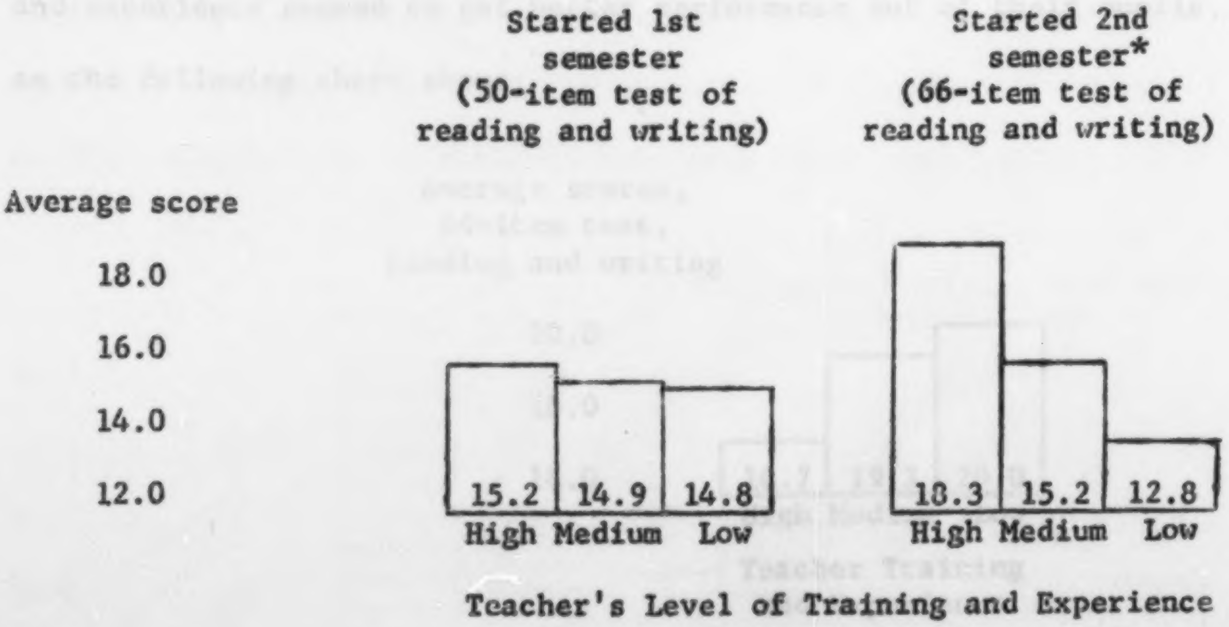
Our interpretation of these results, as we have indicated, is that pupils who have not yet mastered the language audio-lingually need more help, and a more adaptive drill-master, than programmed instruction provides. The "readiness" which we have been talking about therefore appears to be a readiness to study the type of reading and writing in our programmed materials. In the first semester, it appears that many pupils were not ready for independent study of reading and writing, and therefore did much better under the direction of a teacher. In the second semester, they were ready for independent work, and therefore did better with a program.

As indicated, we do not believe this means that all study of reading and writing should be postponed until second semester. Recall the evidence cited: (1) Starting reading and writing first semester does not penalize the audio-lingual learning. (2) Pupils who have teacher-directed reading and writing in the first semester do well. (3) It is chiefly the pupils who are asked to study reading and writing independently during the first semester who have serious trouble traceable to insufficient previous mastery of listening comprehension and speaking. Therefore, it seems to us that the weight of the evidence is in favor of starting reading and writing in the first semester of the second year, but postponing the use of this particular program until later in the semester or perhaps until second semester.

Later in this chapter we shall be able to demonstrate that both programs and teacher-drill are more effective than either alone.

What effect does the teacher have on programmed instruction?

The preparation and experience of the classroom teacher makes a considerable difference in how well a pupil does with programmed instruction, despite the fact that the teacher handles audio-lingual practice, and the pupils work independently on reading and writing. This may be illustrated by placing the year-end scores on reading and writing against the training and experience of the teacher, as the following chart does:



It will be noted also the teacher makes more difference when the student is "ready" for the program, in the second semester, than in the first semester. Why should this be? A superior teacher is usually able to transfer some of his own enthusiasm and vigor to his pupils. In the first semester, this could be done less effectively because the students were less ready for the program. In the second semester, however, the students were ready to "take off and run", and the teacher's ability to motivate them was reflected in their scores. Whether or not this is the right interpretation, the teacher clearly has an effect on the performance of the pupils.

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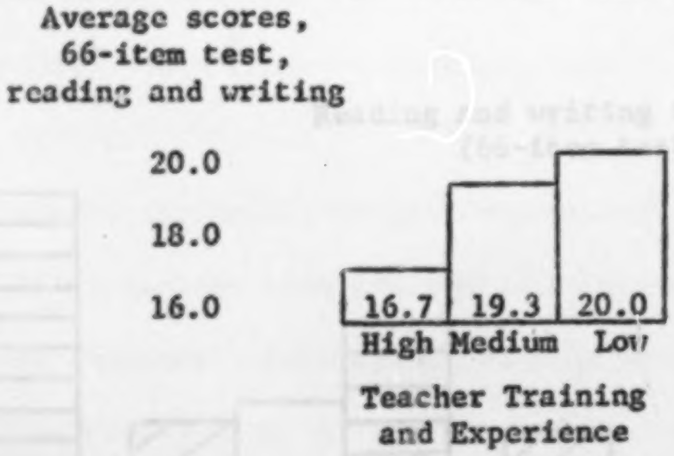
*Those who "started 2nd semester" took the first test (66 items), while those who "started 1st semester" took the second test (50 items).

What is the effect of using a teaching machine?

Strange to report, for pupils who studied their programs in a teaching machine, rather than a programmed text, the teacher effect was exactly opposite. That is, teachers with less training and experience seemed to get better performance out of their pupils, as the following chart shows:

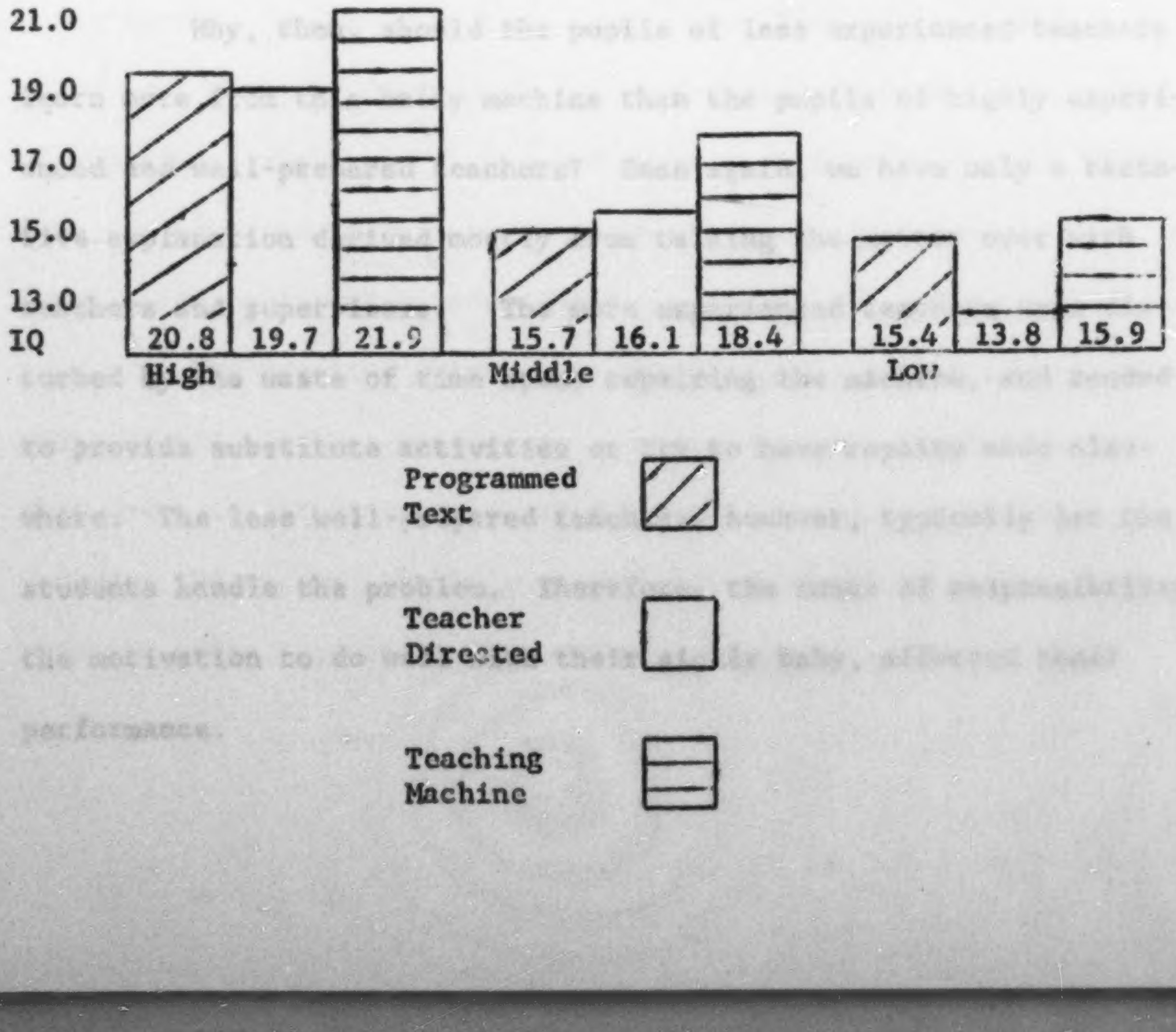


In order to try to understand this, we must have more information about the teaching machine itself.

The particular machine was little more than a cover to hold the program. It was a rather poorly engineered model that was constantly breaking down. The pupils became adept at repairing it. Indeed, some teachers estimated that as much as one quarter of the practice time was taken up with repairing the balky machine. Considering, therefore, that exactly the same program was used in the machine as in the programmed text, and also that previous research has typically shown no difference between performance on teaching machines and identical programmed texts, we expected that there would be no significant difference between the performance resulting from the machine and the program, or -- considering the frequent breakdowns of the machine -- that the programmed text would prove superior.

We were therefore considerably surprised by the results, which showed a consistent superiority for the students who used the machine. Perhaps the best way to show this is in relation to mental ability, inasmuch as we shall want to talk about that next.

Reading and writing test scores
(66-item test)



In short, the pupils who used the machine did better than either the teacher-directed or the programmed-text groups, at every level of mental ability.

By talking with the teachers and some of the pupils, we arrived at a possible explanation of these results. The fact that the machine broke down so often and had to be repaired apparently *involved* the pupils with the machine. They became proud of their ability to keep the machine going. It was *their* machine, and they wanted it to do well. They were responsible for it. They were aware of the attention they were attracting. We have no research evidence for these conclusions, but they have a certain degree of face validity. The effect of the balky machine must have been, not to disadvantage the pupils, but rather to motivate them to work harder and do better with it.

Why, then, should the pupils of less experienced teachers learn more from this balky machine than the pupils of highly experienced and well-prepared teachers? Once again, we have only a tentative explanation derived mostly from talking the matter over with teachers and supervisors. The more experienced teachers were disturbed by the waste of time spent repairing the machine, and tended to provide substitute activities or try to have repairs made elsewhere. The less well-prepared teachers, however, typically let the students handle the problem. Therefore, the sense of responsibility, the motivation to do well with their sickly baby, affected their performance.

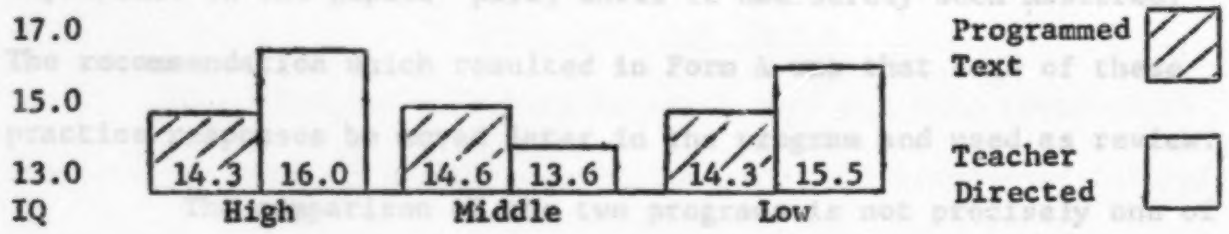
As one teacher remarked, there must be a better way to raise student motivation than by installing an undependable machine to guide their practice. Nevertheless, the experience points out that motivation can be built by giving pupils more responsibility.

What is the effect of programmed instruction on students of different mental ability?

Throughout these experiments we found the expected relation of performance to mental ability: brighter pupils learned more, regardless of method. This finding was so uniform that we have said little about it. In the case of programmed instruction, however, we were especially interested in this relationship. Much has been written about the possible interaction of programmed instruction and intelligence. It has been conjectured that programs, by letting slower students work at their own pace and master every step before going further, would bring them nearer the class average; and on the other hand that, by freeing the brighter students from the lockstep of the class, might permit them to surge even further ahead. Therefore, we were specially interested in what our results would tell us about these predicted relationships.

The previous chart gives the pertinent data for the second year, second semester reading and writing scores. It is apparent that there is little evidence of differential effect by method. Whatever the method, the brighter students learned more than other students using the same method.

In the following chart are results for the first semester when, we have conjectured, pupils were not yet quite "ready" for individual work:


Reading and writing test scores (50-item test)

These results are far from clear. They seem to suggest that, when many pupils are not yet quite ready for independent study, use of a program does tend to equalize performance -- but at an average level below that of teacher-directed drill.

On the basis of these results, however, we are in no position to say that programmed instruction, teaching reading and writing skills in elementary school Spanish, is differentially helpful either to the bright or the slow students.

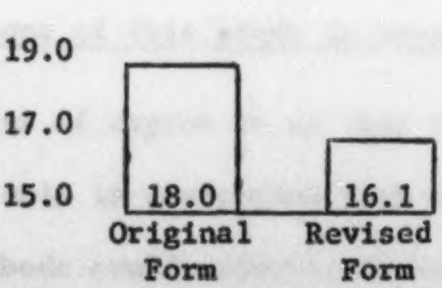
Effect of different forms of the program

The programmed text was studied in two forms. The first of these, which we shall call Form I, was the original program made and tested on pupils one at a time, revised, tested again, and so on until it was ready to test on an entire class. A second version of the program, which we shall call Form A, was made on the advice of a well-known and highly respected center for the study of programmed instruction, to which Form I had been sent for criticism. The critics recommended that some of the items should be rearranged so as to spend less time practicing the desired response when it is first evoked. Form I sounded a bit like a classroom teacher, drilling a class, keeping them practicing a response, despite possible impatience on the pupils' part, until it had surely been mastered. The recommendation which resulted in Form A was that some of these practice responses be moved later in the program and used as review.

The comparison of the two programs is not precisely one of spaced practice vs. massed practice, because there was considerable spaced practice in both forms; nor of short steps vs. long steps, because both programs contained the same number of steps. Rather, it was a test of the ability of sophisticated critics to make an effective program more effective by exercising editorial judgment without testing it on students.

Editorial judgment turned out to be fallible, as the following chart shows:

Average scores on reading and writing
(66-item test)



The original form of the program produced more learning, had a lower error rate, and required less time to complete. It was another demonstration that in choosing between two relative, skillfully made programs, editorial judgement is unreliable in predicting the amount of learning that will occur. The only dependable way to choose between them is to test them on the kinds of students they are supposed to teach.

Error rate and time

Our findings in regard to error rate and time required to complete the program confirmed previous work with programmed instruction. Both error rate and time correlated negatively with the amount of learning (-.285 and -.255, respectively). In other words, a student who made fewer errors and worked more swiftly through the program made a better score at the end.

Effect of programmed phonics

Ten sixth-grade classes were given a short program in phonics at the beginning of the first semester. This made a significant contribution to their score on the speaking test. (See Table 21-b.)

Limitations of this study of programming

It was a matter of regret to us that we were able to study programmed instruction only in connection with the reading and writing skills. Programmed methods could undoubtedly have been used to teach both listening comprehension and speaking. Indeed, some of the dual-channel tape recorder practice was "programmed" by individual teachers. But the construction of an effective program is a slow and costly activity. It took nearly two years to make and test the program used for reading and writing. There was not enough time, or money, or machines to make possible a similar program in listening or speaking.

The ETS study of the program

As mentioned earlier in this report, the Educational Testing Service prepared teacher and pupil interest tests, which we administered to the sixth-grade pupils and teachers at the beginning and end of the first semester of the third year. ETS then used the data from these tests, plus the performance data which we gathered and the background information on the pupils, to evaluate the program used in Denver. They compared the groups whose classroom practice in reading and writing was given entirely by programmed instruction, entirely by teacher, and by a combination of the two methods. They discovered, as we had, that in the first semester of the sixth grade, the program-only group did least well, and there was no advantage, so far as performance scores revealed it, in adding a program to the teacher-drill. (In the second semester, it will be recalled, the program did make for better performance.) But when the ETS researchers analyzed the data further, they did find some advantages associated with the program, even in the first semester.

We thus have the benefit of an independent analysis of some of the same data which we used. Here, with the permission of the authors, are the conclusions of the paper in which ETS first reported its results:*

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*Maier and Jacobs, op. cit., pp. 13-15.

In this study we considered the instructional technique, teacher attitudes, and the student input abilities and attitudes as the sources of influence. The outcomes we considered were achievement and attitudes. Our task in evaluating a program was to compare the effects of the program on the mean level of outcomes and on the variables' interrelationships with those of other instructional techniques.

We found that in the teacher plus program taught group, the instructional process was an orderly affair: interest, aptitude, and achievement were all intercorrelated, and teacher attitudes were related to validities in a known manner. In the other two groups, program taught and teacher taught, the interrelationships among these variables were not as orderly; we cannot account for the variation from class to class or student to student as well in these two groups.

Our conclusions about this program are as follows:

1. The program is an effective part of the instructional process, especially when combined with a trained teacher. Used only with a proctor, it is not as effective. The program has neither a beneficial nor detrimental effect on student interests in Spanish. The program as used here does not significantly affect individual differences in achievement.

2. The IQ test and Spanish pretest are as valid predictors of achievement in the program taught group as in the teacher taught and teacher plus program taught groups. This is true whether the class or individual student is used as the unit of observation.

3. Experience with programmed instruction seems to affect teacher attitudes toward Spanish and instructional methods. Among the trained teachers using the programs, those who liked Spanish also wanted to use televised and programmed instruction and didn't want to use regular instruction. Among the trained teachers not using programmed instruction, those who liked Spanish did not want to use televised instruction and did want to use regular instruction.

4. Interest in independent study is more highly related to aptitude and achievement in the teacher plus program group than in the other groups. As a

suggestion, if you want to develop an interest in studying Spanish among high ability students or classes, use trained teachers plus a program.

5. The validities of the IQ test and pretest for predicting achievement in a class vary from zero to high positive in each instructional group. In only the teacher plus program taught group are the validities affected by teacher attitudes. As another suggestion, if you want high validity for an aptitude test, use programmed instruction with trained teachers that have favorable attitudes toward Spanish and programmed instruction.

THE MOST EFFECTIVE COMBINATIONS

What were the most effective combinations of classroom activity in the audio-lingual year?

In the early pages of this chapter we were able to show that the experience and preparation of the teacher were dominant factors in determining what kind of classroom practice works best in teaching listening comprehension. If the teacher is highly trained and experienced, then, so far as possible, practice time should be used for drill directed by the teacher himself. If the teacher is very inexperienced, then he may not be able to supervise the efficient use of electronic aids. Electronic aids were most valuable in a classroom where the teacher was at an intermediate stage of preparation and experience. Supposedly a large proportion of teachers in elementary school Spanish would be in this classification, and as they acquired skill in teaching the language they might depend more on their own classroom drill, less on the electronic aids.

This is for listening comprehension. For practice in speaking, it is clear that electronic aids are helpful regardless of the teacher's level of preparation and experience. Therefore, such aids definitely belong in the audio-lingual year.

What kind of aids? We were unable to show that one kind was significantly better than another in the classroom, but the experience of teachers reported in Chapter 7, and the comments of other teachers who had a chance to try more than one kind of aid, were unanimous in putting the dual-channel tape recorders at the top of the popularity poll, and record players at the bottom. The advantage of a tape recorder, of course, is that a pupil can hear his own Spanish played back to him. The advantage of a dual-channel recorder is that a pupil can hear both *his* Spanish and an expert model for it. The general impression was that the dual-channel recorders were not used to their maximum in many classrooms. To be as effective as possible, they require expert models and a kind of programming of practice exercises -- something that not many teachers could provide. Those who could do so were highly enthusiastic about the devices, and felt that they would make for clearly superior learning if used to their full capacity. It may well have been, therefore, that the comparison of the dual-channel recorders with the other devices was not entirely fair to the recorders.

One other unanimous comment of the laissez-faire teachers supplies further basis for using electronic aids in audio-lingual teaching. These teachers pointed out the great need for variety.

Thus, even though the teacher is able to conduct very skillful practice, still it may be advantageous to interest or morale to introduce some other kind of drill for a part of the time.

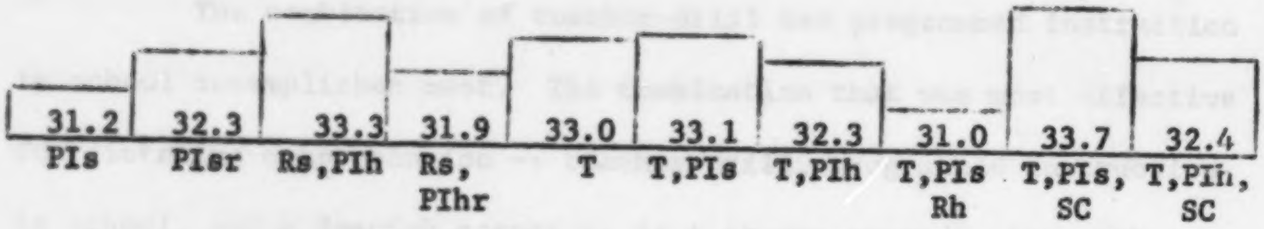
Our conclusion is, therefore, that a combination of teacher-directed drill and an electronic practice aid (preferably a dual-channel tape recorder) provide an effective, simple, and feasible classroom context for television in the audio-lingual year. To these we shall suggest, in the following chapter, the addition of parent participation in viewing and practicing at home. The total makes a highly potent package.

What were the most effective combinations of classroom activity in the listening-speaking-reading-writing year?

In the sixth grade, with reading and writing added to the audio-lingual skills, larger and more complex combinations were possible. Therefore, we devoted a considerable part of the sixth-grade research in the third year of study to sorting out the most effective of these combinations.

Listening comprehension

The study turned up very substantial differences in the effectiveness of the different combinations, as the following figure shows:



PI = programmed instruction
T = teacher-directed drill
R = extended reading
SC = Spanish corner

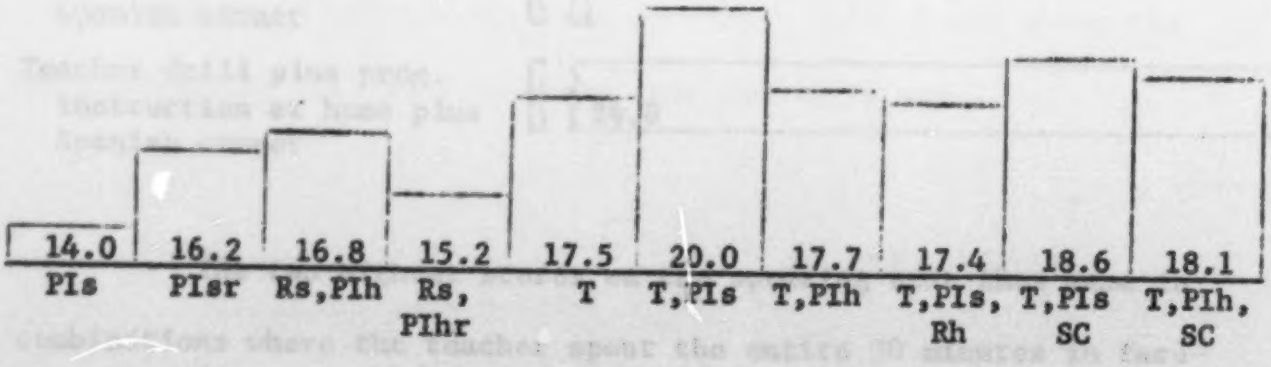
r = revised version
h = at home
s = at school

(50-item test)

It is clear that the combination of teacher drill, programmed instruction in school, and a Spanish corner, is a very powerful one, and accomplishes more than any of the others tried. The combinations of teacher drill and programmed instruction, and of extended reading in school with programmed instruction at home, are also very effective.

Reading and writing

Here again we have some rather large differences.

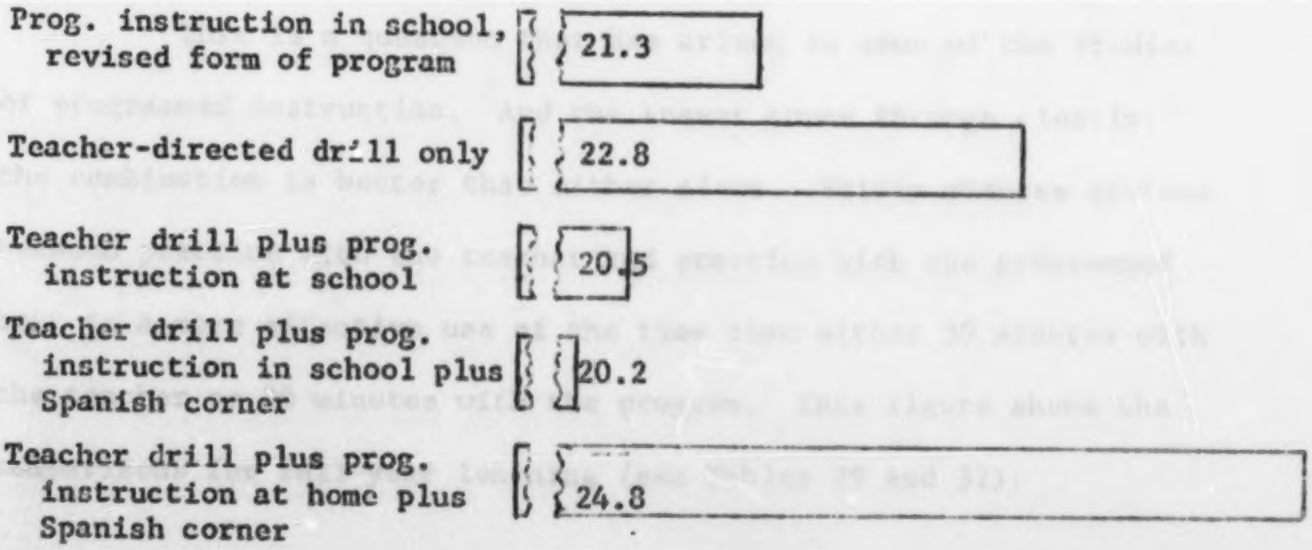


(50-item test)

The combination of teacher-drill and programmed instruction in school accomplishes most. The combination that was most effective for listening comprehension -- teacher drill, programmed instruction in school, and a Spanish corner -- is a strong second. Inasmuch as this combination is best for audio-lingual learning, and second best for reading and writing, it has much to recommend it.

Speaking

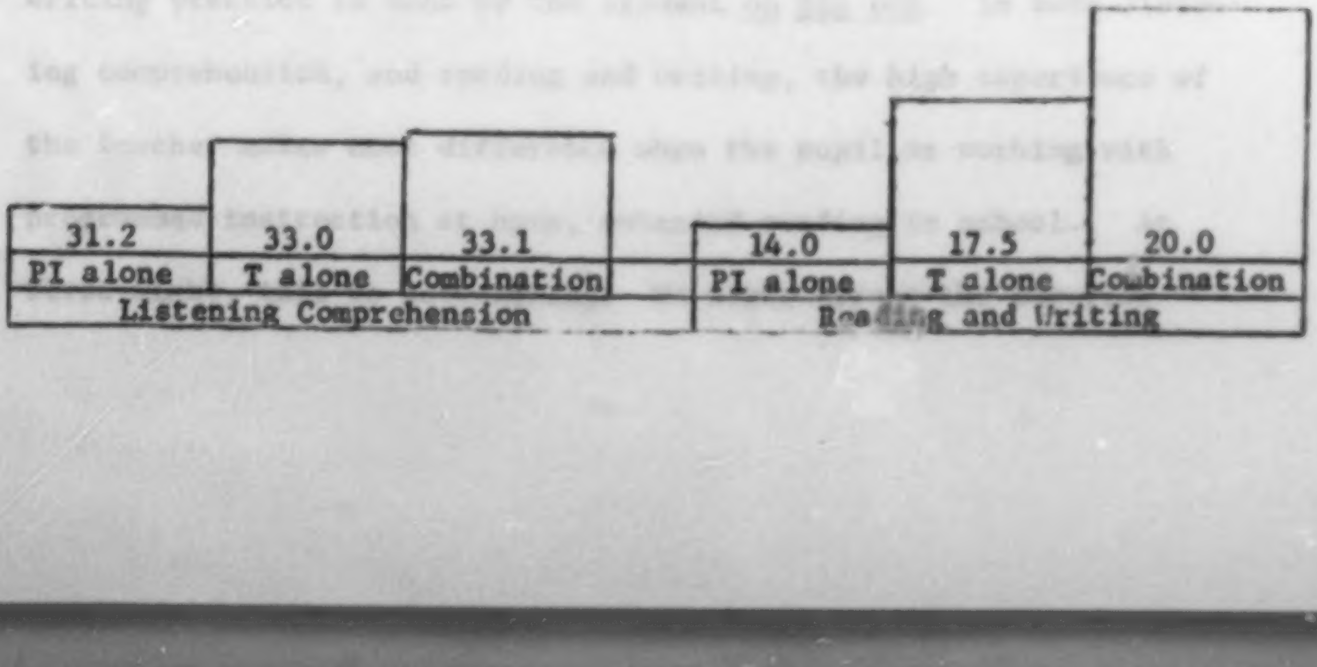
The small numbers in the individually administered test of speaking ability enabled us to test only five of the ten experimental groups. Here are the results:



The two highest scores on the speaking test thus came in combinations where the teacher spent the entire 30 minutes in face-to-face practice. Assuming that the best way to improve speaking is to practice it, with criticism, then teacher-directed practice should accomplish most, and any combination that takes time from that classroom practice will lessen the efficiency of the learning. This is apparently what happened. However, when programmed instruction at home, and a Spanish corner for use outside the Spanish class time, were added to the teacher drill, the result improved the speaking score still further. Thus, on the test of speaking, as on listening comprehension and on reading and writing, we come to the combination of teacher-directed drill, programmed instruction, and a Spanish corner, as a specially effective and promising one.

Is a combination of programmed instruction and teacher-directed practice more effective than the same time devoted to either one of those alone?

This is a question that has arisen in some of the studies of programmed instruction. And the answer comes through clearly: the combination is better than either alone. Thirty minutes divided between practice with the teacher and practice with the programmed text is a more effective use of the time than either 30 minutes with the teacher or 30 minutes with the program. This figure shows the comparisons for full-year learning (see Tables 29 and 32):



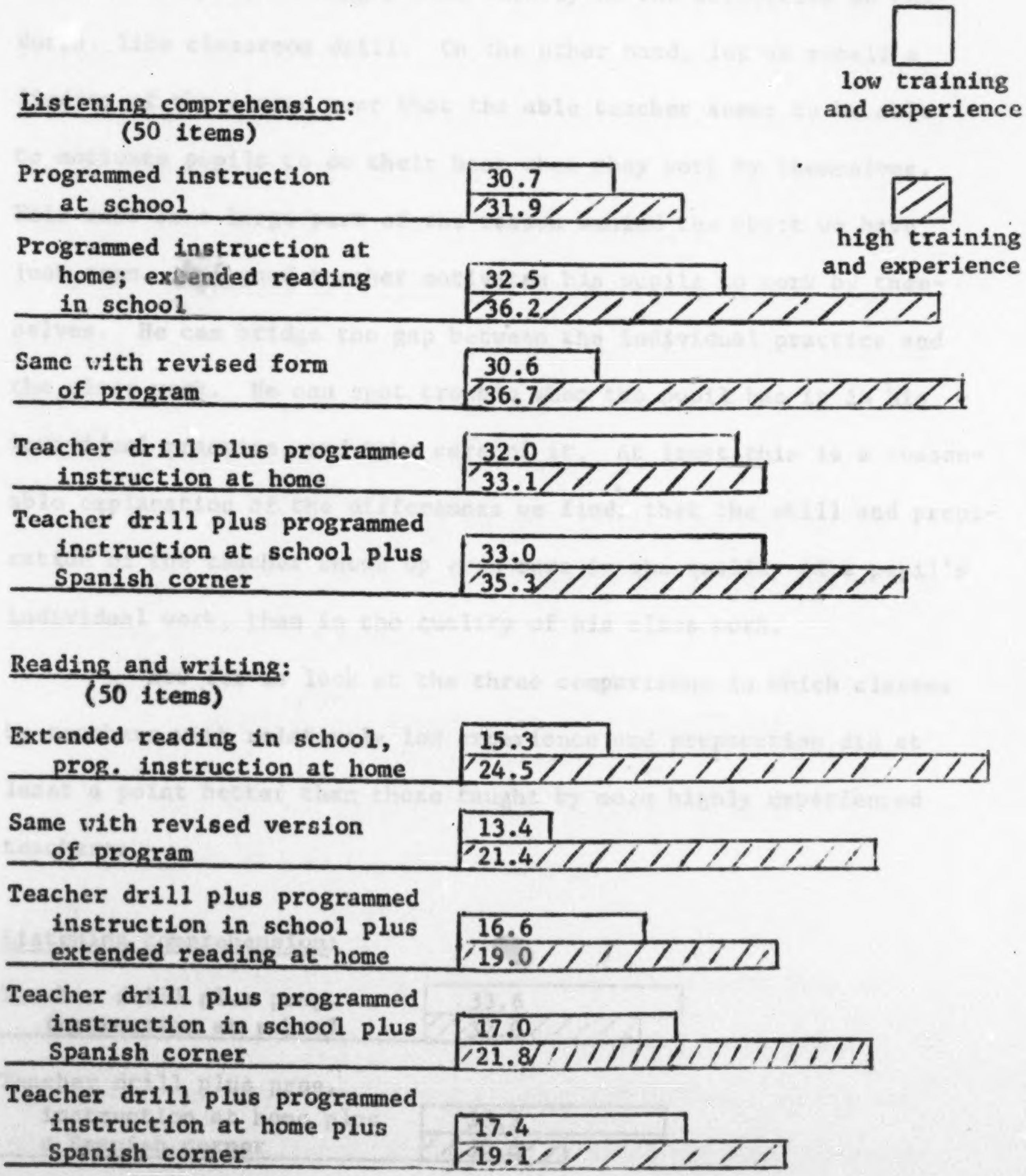
The differences are most striking in reading and writing, which is to be expected, inasmuch as the program is intended to teach reading and writing. Less expected is the strong performance of the program-teacher combination in listening comprehension.

Are any of these sixth-grade combinations especially effective either for teachers high in preparation and experience, or for teachers with little preparation and experience?

In thirteen of the experimental combinations, there was a difference of more than a point in the adjusted average scores of classes taught by highly experienced teachers and less experienced ones. Ten of the comparisons were in favor of the experienced teacher. Let us look at those first (see page 103).

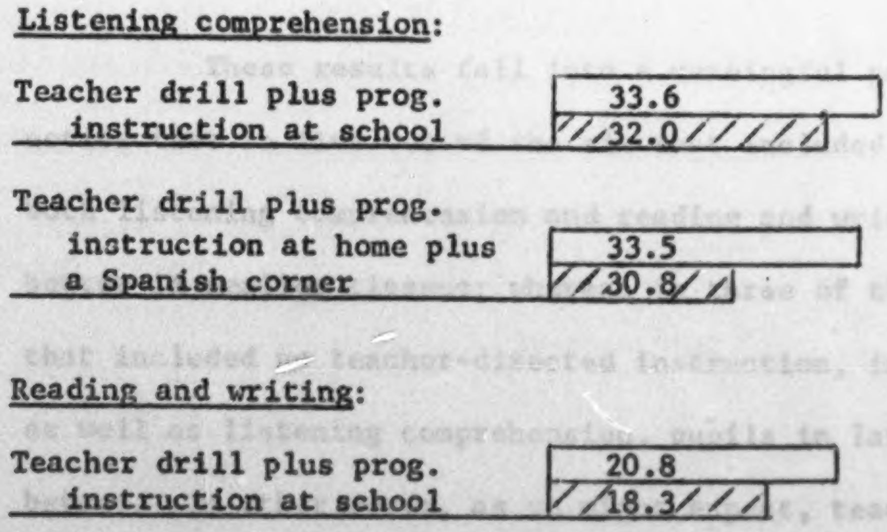
Some of these differences are very substantial. Two of them in the reading and writing group represent more than 50 per cent increase in the lower score. What is it that characterizes the groups in which experience and training in Spanish on the part of the teacher is such a notable advantage?

The case is not entirely clear, but the greatest differences occur in combinations where all or most of the reading and writing practice is done by the student on his own. In both listening comprehension, and reading and writing, the high experience of the teacher makes most difference when the pupil is working with programmed instruction at home, extended reading in school. At first sight, this is astonishing. We might expect the superior


□ low training and experience
▨ high training and experience
Listening comprehension: (50 items)
Programmed instruction at school
30.7
31.9
Programmed instruction at home; extended reading in school
32.5
36.2
Same with revised form of program
30.6
36.7
Teacher drill plus programmed instruction at home
32.0
33.1
Teacher drill plus programmed instruction at school plus Spanish corner
33.0
35.3
Reading and writing: (50 items)
Extended reading in school, prog. instruction at home
15.3
24.5
Same with revised version of program
13.4
21.4
Teacher drill plus programmed instruction in school plus extended reading at home
16.6
19.0
Teacher drill plus programmed instruction in school plus Spanish corner
17.0
21.8
Teacher drill plus programmed instruction at home plus Spanish corner
17.4
19.1

teacher to show his ability more clearly in the activities he conducts, like classroom drill. On the other hand, let us recall a finding of the second year that the able teacher seems to be able to motivate pupils to do their best when they work by themselves. This must be a large part of the reason behind the chart we have just seen. The good teacher motivates his pupils to work by themselves. He can bridge the gap between the individual practice and the class work. He can spot trouble when the pupil has it in his individual practice, and take care of it. At least this is a reasonable explanation of the differences we find: that the skill and preparation of the teacher shows up even more in the quality of a pupil's individual work, than in the quality of his class work.

Now let us look at the three comparisons in which classes by teachers with relatively low experience and preparation did at least a point better than those taught by more highly experienced teachers:



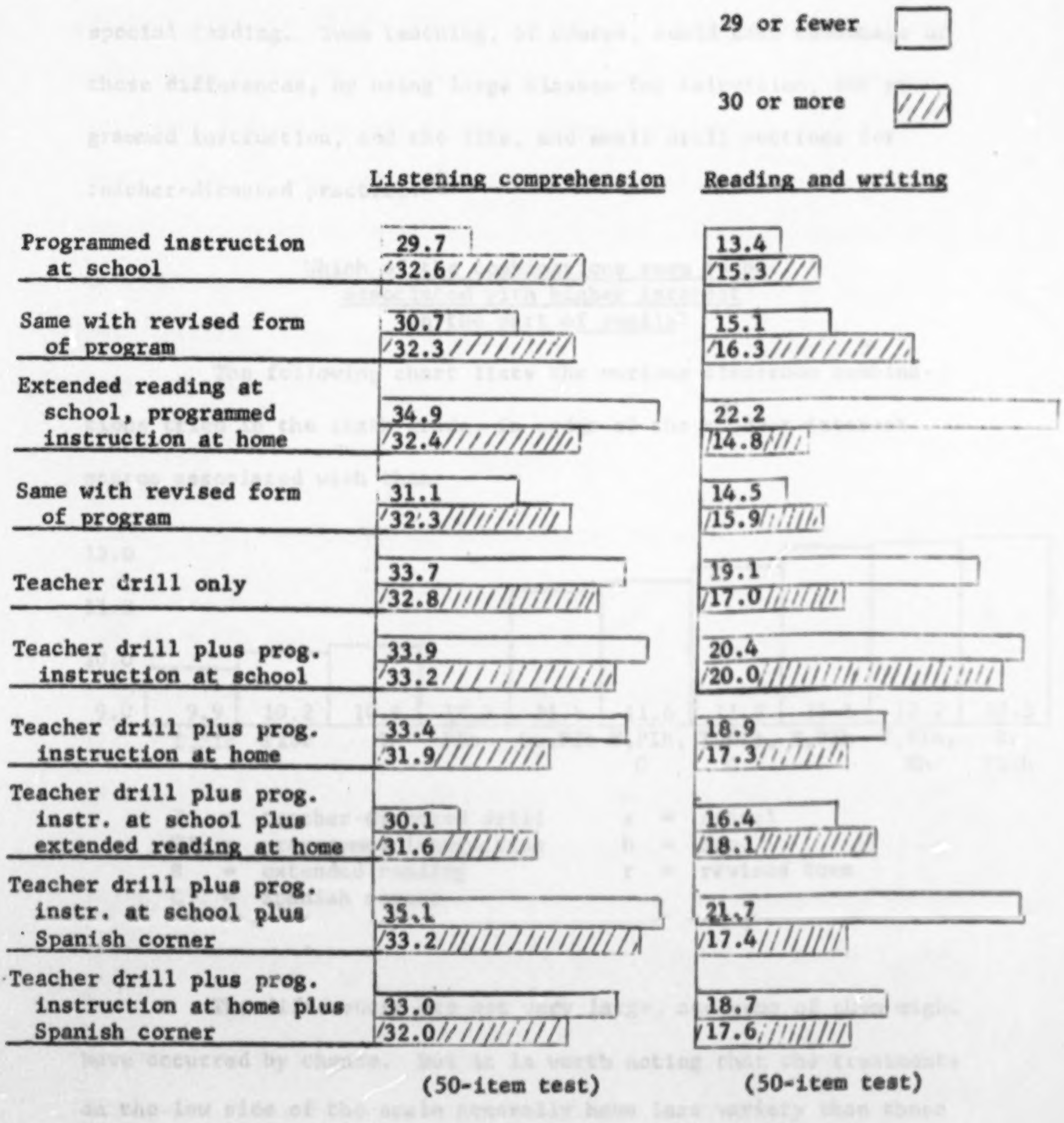
These differences are not so large as some of the others, and neither is their significance entirely clear. This at least may be said, that all the comparisons include teacher drill on reading and writing, and two of them have all the practice in the classroom, so that the pupil is on his own as little as possible. The third group (teacher drill plus programmed instruction at home plus a Spanish corner) works better for less experienced teachers in listening comprehension, better for highly experienced teachers in reading and writing. The reason is not evident.

The important finding in this group, however, is the substantial influence of teacher experience and preparation on the individual work of the pupil.

Which of the combinations are significantly affected by class size?

Here are the adjusted means, compared by size of class -- 29 or fewer, 30 or more pupils: [See page 106.]

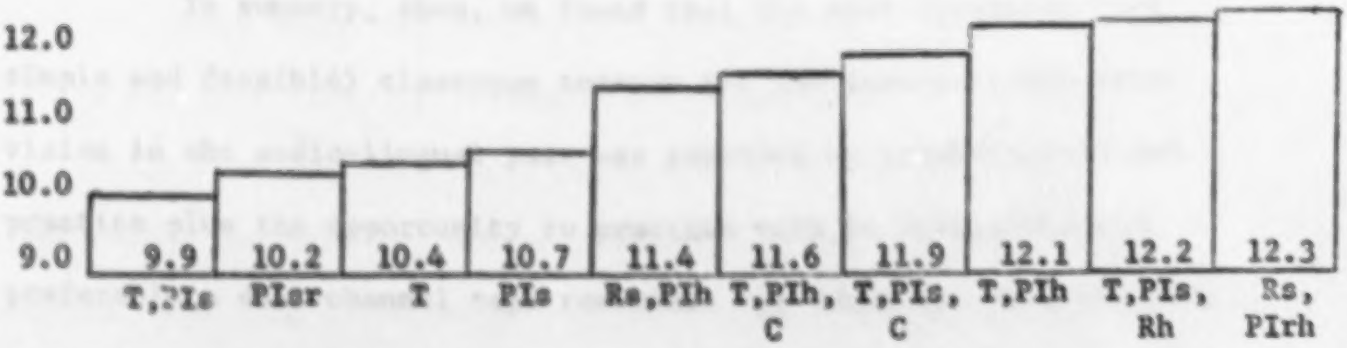
These results fall into a meaningful pattern when we notice that in five out of the six that included teacher drill, in both listening comprehension and reading and writing, pupils did better in smaller classes; whereas in three of the four treatments that included no teacher-directed instruction, in reading and writing as well as listening comprehension, pupils in larger classes did better. In other words, as we might expect, teacher-directed classroom drill seems to be more effective in small classes, but class


29 or fewer
30 or more
Listening comprehension
Reading and writing
Programmed instruction at school
29.7
32.6
13.4
15.3
Same with revised form of program
30.7
32.3
15.1
16.3
Extended reading at school, programmed instruction at home
34.9
32.4
22.2
14.8
Same with revised form of program
31.1
32.3
14.5
15.9
Teacher drill only
33.7
32.8
19.1
17.0
Teacher drill plus prog. instruction at school
33.9
33.2
20.4
20.0
Teacher drill plus prog. instruction at home
33.4
31.9
18.9
17.3
Teacher drill plus prog. instr. at school plus extended reading at home
30.1
31.6
16.4
18.1
Teacher drill plus prog. instr. at school plus Spanish corner
35.1
33.2
21.7
17.4
Teacher drill plus prog. instruction at home plus Spanish corner
33.0
32.0
18.7
17.6
(50-item test)
(50-item test)

size has comparatively little effect on programmed instruction or special reading. Team teaching, of course, could take advantage of these differences, by using large classes for television, for programmed instruction, and the like, and small drill sections for teacher-directed practice.

Which of the combinations seem to be associated with higher interest on the part of pupils?

The following chart lists the various classroom combinations tried in the sixth grade, in order of the student interest scores associated with them:



T = teacher-directed drill
PI = programmed instruction
R = extended reading
C = Spanish corner
s = school
h = home
r = revised form

The differences are not very large, and some of them might have occurred by chance. But it is worth noting that the treatments on the low side of the scale generally have less variety than those on the high side. Three of the four lowest combinations consist either of teacher drill or programmed instruction alone. It seems justified to conclude, therefore, that variety in the teaching of a subject like Spanish contributes to pupils' interest in it. It is also worth noting that homework does not seem to make for lowered interest; five of the six highest combinations include some homework. Finally, we should record that the combination of teacher drill, programmed instruction in school, and a Spanish corner, which we found to produce the best learning scores, is near the top of this interest scale, and insignificantly different from the top interest score.

SUMMING UP

In summary, then, we found that the most effective (yet simple and feasible) classroom context for the instructional television in the audio-lingual year was provided by teacher-conducted practice plus the opportunity to practice with an electronic aid, preferably a dual-channel tape recorder. We found the eclectic form of drill to be at least as effective as the other forms tested, and more effective, with relatively inexperienced teachers, than dialogue practice; and it was the form preferred by the teachers. The teacher-directed practice provides a quite effective context itself, but the addition of an electronic aid makes for a significant increase of skill in speaking the language; and under certain conditions -- notably when Spanish is not spoken in the home, and when the teacher is relatively inexperienced in teaching Spanish but still experienced enough to supervise the use of electronic aids --

it also contributes to the development of listening comprehension skills. The electronic aid also adds variety, which contributes to class interest and morale.

The most effective classroom combination for the second year of the language -- the sixth grade, audio-lingual-reading-writing year -- proved to be teacher-directed practice, programmed instruction in school, and a Spanish corner for individual use in the classroom. This combination produced the highest scores in listening comprehension and speaking, and was insignificantly different from the most effective combination (teacher drill and programmed instruction only) for reading and writing scores. A striking fact was noted about the effect of different levels of teacher preparation and experience on the numerous combinations of classroom activities tested in the sixth grade: the chief effect on pupil performance was that the better prepared and more experienced the teacher, the more efficiently a student could work on his own, with programmed instruction, extended reading, individual practice, and so forth. Another interesting finding was about class size: for teacher-directed activities, small classes tended to perform better; for individual activities, like programmed instruction, large classes tended to perform better. The inference is that team teaching, using small practice groups under the most skillful teachers, and large groups to watch the television and work with programmed instruction and other individual activities, might be the most efficient way to handle this course.

Timing turned out to be important in the sixth grade. No ill effect on listening comprehension or speaking was found when the study of reading and writing was begun in the first, rather than the second, semester of the sixth grade. Teacher-directed drill on reading and writing works well in that first semester, but it was found that, for most pupils, programmed instruction is better started in the second semester when the student has a better command of the heard and spoken language and is "ready" to work independently on reading and writing. A score of around 30 on the listening comprehension pretest seemed to predict when the student was "ready" to do well with programmed instruction.

Among many findings about the use of programmed instruction in this course, one of the most interesting was the demonstration that teacher preparation and experience are apparently reflected strongly in pupils' independent work with programs. Another interesting result was the effect of pupil involvement with a balky teaching machine which had constantly to be repaired and for which the pupils came to feel responsible. Where pupils were permitted to take responsibility for "their" machine, they made higher scores than other groups. No differential effect on pupils of different mental abilities was found associated with the program; as usual, scores rose with ability. It was demonstrated again that even "experts" are unable to predict which of two relatively skillful programs is likely to produce more learning; the experts guessed wrong on the Denver program. The program worked even better with large than with small classes. And it should also be noted that an independent study of the Denver programmed textbook, by the Educational Testing Service, resulted in an encouraging degree of confirmation for our findings.

Finally, the level of pupil interest in the Spanish course was found to be related closely, in the sixth grade, to the level of interest developed previously in the fifth grade, and to the variety of study experiences offered in the sixth grade. In producing interest, the combination of teacher drill, programmed instruction, and Spanish corner, was as good as the best, further encouraging us to recommend that particular context.

6. PARENTS AND HOME PRACTICE

When we began this study we were by no means sure that parents either would or could be of any important help to their fifth- and sixth-grade children in learning Spanish. In fact, the trend has been rather against it. Over the last 30 years, the parent has tended to assume less responsibility for his child's studying. In subjects like the new mathematics, parents who have no special training themselves are urged not to try to help their children with homework, lest their "old" mathematics confuse the children about the new. The Foreign Language in the Elementary School program (FLES) has warned repeatedly about the importance of establishing proper habits of pronunciation, and avoiding translation in the early period of foreign language study. We wondered whether parents would provide good models for pronunciation, and whether they would not be inclined to translate. Furthermore, we didn't know how many parents would be willing to give the time to study elementary Spanish with their children.

Nevertheless, we thought it was worth finding out whether the parent could be added as an effective member of the team we were developing. The Denver Schools enlisted the interest of the Denver County PTA, which agreed to sponsor actively this part of the project. The PTA took responsibility for obtaining volunteers, supplying them with materials, and serving as liaison between parents and project personnel. Indeed, without the interest and energy of the PTA this part of the experiment would not have been possible.

Through the PTA, we asked parents to view the evening repeat of the television class with their children, as often as they could; and to practice Spanish with their children. To help with practice, we supplied a handbook which followed the television classes, listing vocabulary and suggesting forms of practice. We also supplied a long-play phonograph record as a model of pronunciation. Parents were asked not to let their children see any written Spanish, not to translate, to use Spanish as much as possible in everyday context in the home, and to hold specific practice sessions when they felt these were needed.

How many parents participated?

We were agreeably surprised at how many parents were willing to take on these responsibilities. Materials and instructions were supplied only to volunteers, and during the first year the only volunteers accepted were those from classes in which at least half the parents volunteered. We hoped to get, that first year, as many as 600 pairs of parents. We got 1,240. As the word got around, more and more parents sought to volunteer. In the second year we had approximately 2,850 pairs of parents participating in the fifth-grade study. This is the trend of parent participation during the three years:

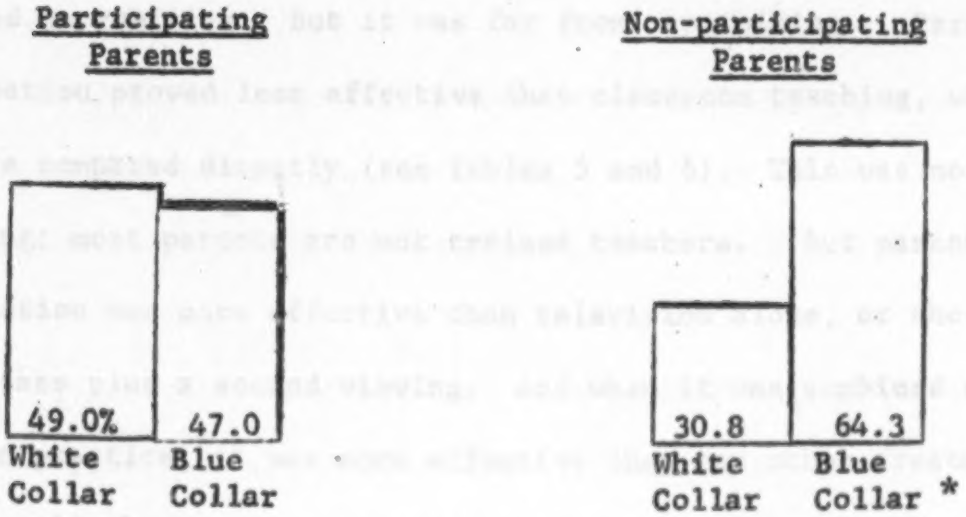
	1960-61	1961-62	1962-63
Fifth Grade	1,240	2,850	2,874
Sixth Grade		870	1,770

The arrows mean that parents who participated in the second year of Spanish had to come from the group who had participated in the previous year. There is apparently an attrition of about one-third between the years, indicating not only that some families lose interest, but also that many of them have moved away or for other reasons become unable to follow through.

But our conclusion is that, in a city like Denver (especially if it has an active PTA), up to about one-half of the parents (total registration for each grade in Spanish was about 6,000) can be counted on to participate, at least to some extent, in their children's home study of Spanish.

Who participated?

The volunteers were not even representative of the Denver population. White-collar workers (clerical, sales, managerial, proprietors, professional and technical) were over-represented, blue-collar workers (service, unskilled, semi-skilled, and skilled) were under-represented, as this figure shows:



As the study went on, this difference became less extreme, and more and more parents from the blue-collar occupations began to participate. But there remained an imbalance. Parents with more education, parents in the white-collar occupations, were more likely to help. Their children were likely, on the average, to have slightly higher IQ's and grade-point averages, and to score higher on achievement tests (spelling, language, word meaning, paragraph meaning, and so forth).[**] These differences, of course, had to be allowed for by analysis of covariance.

What effect did parent participation have on pupils' classroom performance?

We tested the effect of parent participation in the first year of the study so that the method could be quickly discarded if

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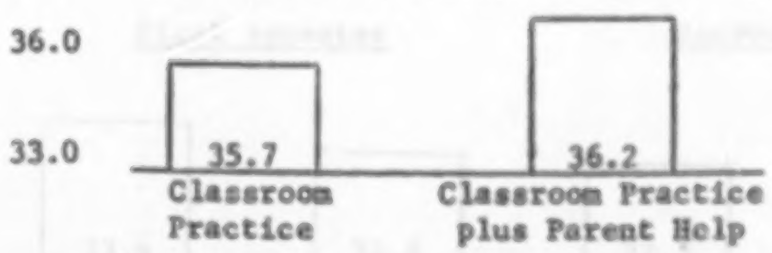
[*] A small percentage of parents could not readily be classified under these two headings; therefore, the totals do not add to 100 per cent.

[**] See the first report of this project, A New Opportunity for Parent Participation in Education, pp. 10-11.

it proved unpromising. But it was far from unpromising. Parent participation proved less effective than classroom teaching, when they were compared directly (see Tables 5 and 6). This was not surprising; most parents are not trained teachers. But parent participation was more effective than television alone, or the television class plus a second viewing. And when it was combined with classroom practice, it was more effective than any other treatment. Combined, all the groups that had classroom practice plus parent participation scored more than half a point above groups that had classroom practice only:


Listening comprehension (50 items)

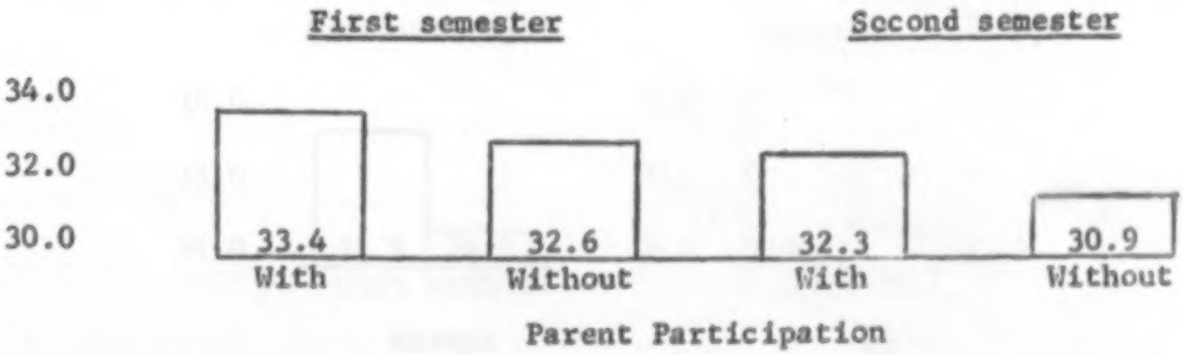
The difference is not quite significant at the .05 level, but it indicates that the combination is a potent one. We decided to retain parent participation, and if possible to extend and improve it.

The sixth-grade pupils whose parents participated in home viewing and practice during 1961-62 were the fifth graders who had been studied the previous year. We were interested in finding out whether the effect would persist. We thought it probable that any "Hawthorne" effect -- the effect of novelty and special attention --

would be gone by the second year. If parents were going to get tired of their part of the arrangement, they would probably have gotten tired long before the second year. Therefore, the 1961-62 experiment was a good test of the potency and lasting power of parent participation.

The results, however, were very much like those of the first year. Children whose parents participated did better than others. Even when we adjusted the score to take into account only the amount learned during the sixth grade, still the children of participating parents learned significantly more:

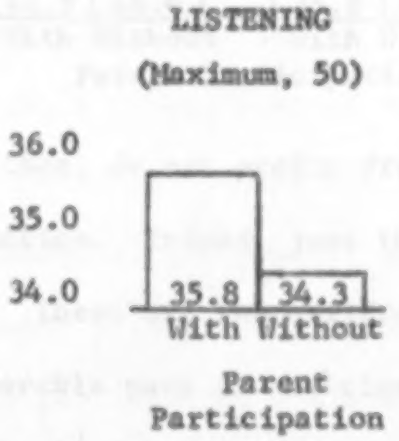
Listening comprehension (50 items)

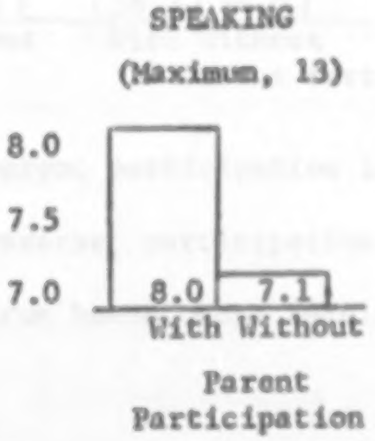


Remember that these figures reflect only the amount learned during the first or the second semester of the sixth grade. The averages that reflect the previous year's learning also were much farther apart. For example, at the end of the first semester the raw means were 35.3 for parent-help pupils, and 32.2 for the others. Thus, the children who had parent help were ahead at the beginning of the year and gained still more during each semester.

In the fifth grade, during 1961-62, we had a new crop of pupils, and a much larger number of parent volunteers. Among these volunteers were a number of parents from households where Spanish is spoken much or most of the time. Denver has many more Spanish-speaking families than the average American city. We became aware that parent participation had a very different effect on children from these households than on children whose families do not speak Spanish.

For example, when we analyzed first semester results, omitting children from Spanish-speaking homes, we got clear and significant differences on both listening and speaking tests:





This was a direct and impressive confirmation of first-year findings.

But in the second semester, when we included all the children from Spanish-speaking homes in the analysis, there was a different result. The amount of Spanish spoken in the home made a difference, but for the over-all group there was no significant difference attributable to parent participation.*

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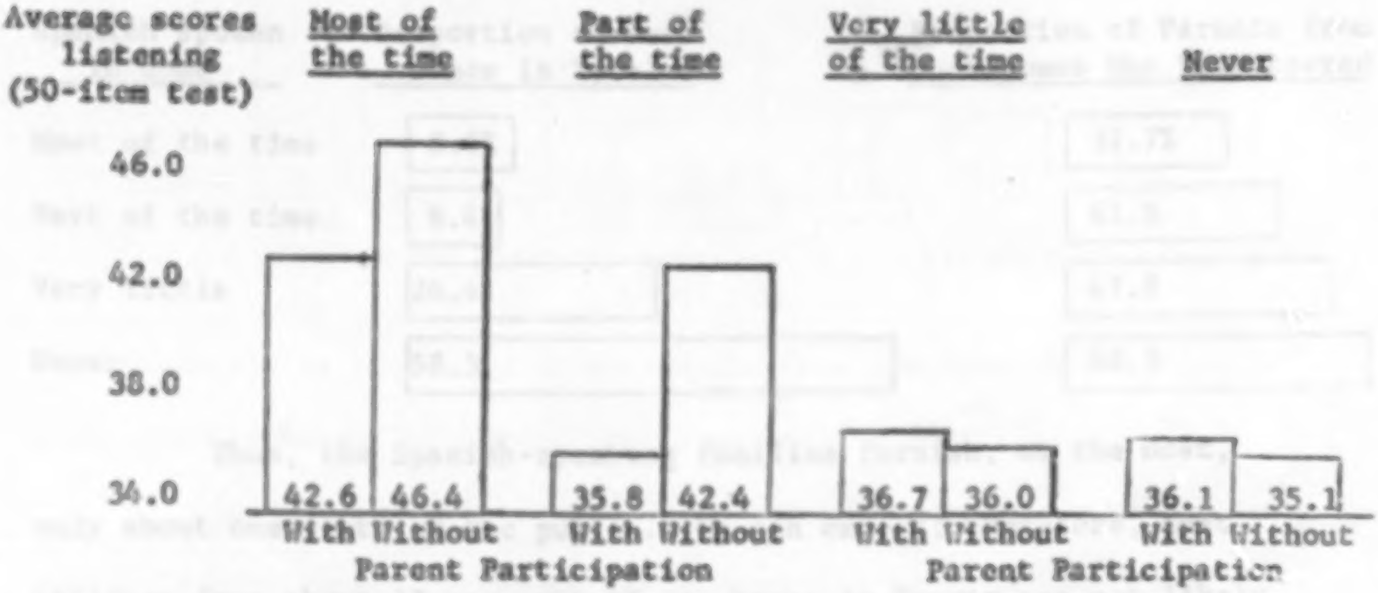
*See Table 13 in the Appendix.

This called for further analysis, and we examined the scores in terms of how much Spanish was spoken in the home. This gave the following results for the full-year scores:

If Spanish is spoken in the home:



Some children, then, do not profit from parent participation in home viewing and practice. Indeed, just the reverse: participation seems to be harmful. These are the children from homes where Spanish is spoken a considerable part of the time.

Why should Spanish-speaking parents be less helpful if they participate in home practice than if they do not? We did some research on this question, in an effort to find what kind of "participation" went on in different kinds of homes, and will report the results beginning on page 124.

An even more important question is, how many children are, because of Spanish in the home, not likely to profit from parent participation?

In Denver, as we have remarked, the number of Spanish-speaking families is larger than in most American cities. A good estimate of the number can be obtained from these figures on the fifth-grade population in 1961-62:

Spanish Spoken in Home	Proportion of Such Homes in Total	Proportion of Parents from Such Homes Who Volunteered
Most of the time	8.7%	32.7%
Part of the time	8.4	42.6
Very little	24.4	47.8
Never	58.5	48.9

Thus, the Spanish-speaking families furnish, at the most, only about one-sixth of the pupils. We can expect, therefore, that children from about 17 per cent of the homes in Denver are not likely to profit from parent participation in home practice and viewing; children from about 83 per cent of the homes are likely to profit. On the other hand, parents from Spanish-speaking homes are less likely to volunteer to participate. And their children, because of the Spanish they have learned at home, are likely to do better in Spanish anyway!

This is the finding that kept repeating itself throughout the remainder of the study. Fifth-grade results in the third year of the project will serve as an example. This figure reflects the full year's learning in listening comprehension.*

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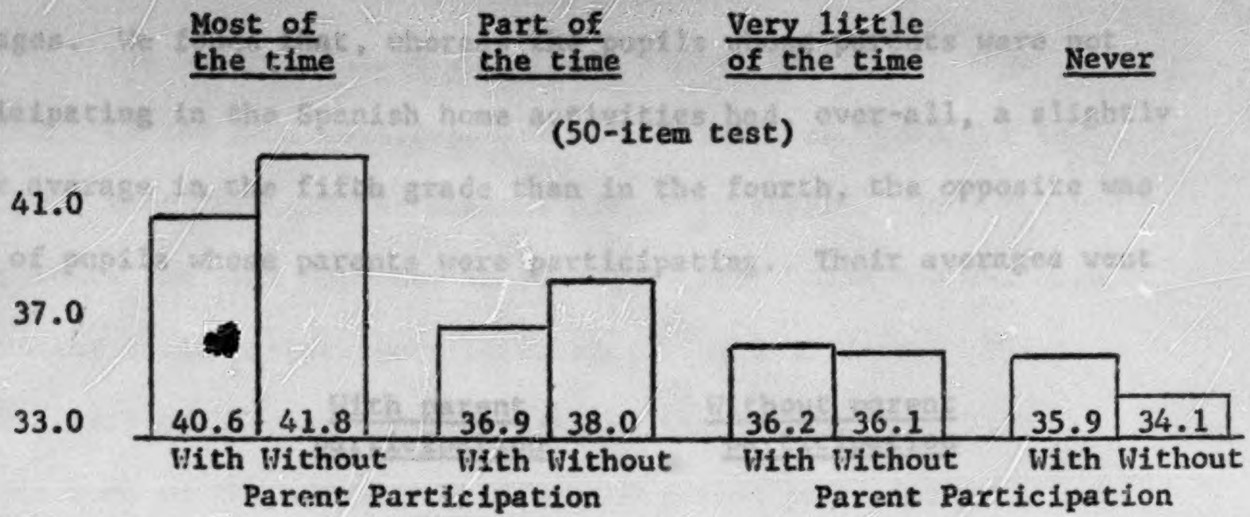
*The means in the following chart should not be compared directly with the means in the chart of 1961-62 results, inasmuch as quite different tests were used.

If Spanish is spoken in the home:



The conclusion is clear: it is the pupils from non-Spanish-speaking homes who are helped by parent participation.

In other words, at least five out of six of elementary school Spanish pupils in Denver are in position to be helped substantially if their parents will participate in home viewing and practice. These parents can be effective team members, along with the television teacher, the classroom teacher, and the teachers who prepare the programmed instruction and other teaching materials. No matter what kind of classroom practice the pupil gets, active participation by his parents in home activities can potentially improve his performance.

What is the effect of parent participation on the pupils' total performance in school?

Because we suspected a general motivating effect from parent participation, we obtained fourth- and fifth-grade academic averages for all pupils registered for Spanish. Grades in English,

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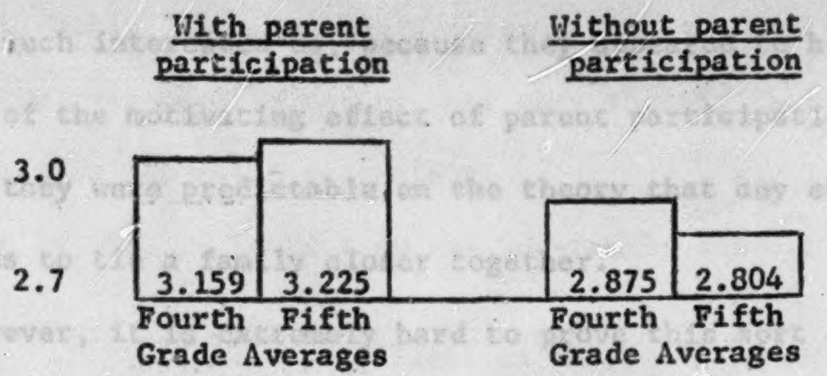
reading, spelling, arithmetic, and social studies were used for these averages. We found that, whereas the pupils whose parents were not participating in the Spanish home activities had, over-all, a slightly lower average in the fifth grade than in the fourth, the opposite was true of pupils whose parents were participating. Their averages went up![*]



This is not a very large difference, but one would not expect an enormous difference in the over-all means of such large and diverse groups. Small as it is, the difference would not occur by chance as often as once in 1,000 times.

We must be cautious in interpreting this finding. We are unable to prove that it was the direct effect of parent participation. Other motivating effects, in the home or elsewhere, might have played a part in it. But we can say with confidence that the children whose parents participated in the fifth grade got better grades than they had received in the fourth, and children whose parents did not participate received poorer grades than they had in the fourth. The difference is significant at the .001 level.

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[*] See Table 9.

What is the effect of parent participation on family relationships?

PTA members passed on to us a number of reports from parents that the home participation activities were "good for the family". They "brought the members closer together". They "helped the parents see what happened in school". They "made the children understand their parents were interested". And so forth. These reports very much interested us, because they appeared to help explain some of the motivating effect of parent participation, and also because they were predictable on the theory that any shared activity tends to tie a family closer together.

However, it is extremely hard to prove this sort of effect without a family study as big as our school study. In the course of an interview survey of 200 families, we did ask a series of questions like these:

> "Has participating in the Spanish project affected your family in any way? For instance, has it caused any problems that have bothered your family?"

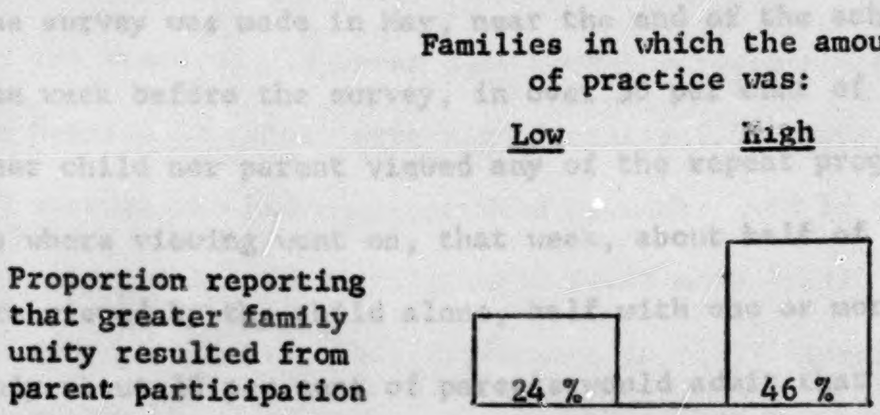
And two questions farther on:

> "Has participating in the Spanish project made your family feel closer?"

About 35 per cent of those who responded said that it had made the family feel closer. The great majority of those respondents said that the whole family, rather than mother and child, or father and child, felt closer.

These answers, of themselves, are not proof. We can check them further, however, by finding out whether the amount of practice a family indulged in was related to feelings of a tighter family bond. We should expect, of course, that volunteers in the parent participation program would feel greater family unity only if they did practice together; and if we were to find that family unity is negatively related to amount of practice, or if there were no apparent relationship, then we should suspect that the family was giving normative responses -- saying what they thought they ought to say, rather than reporting accurately.

Here is what we found from the 200-family survey:



So, as far as we can go at the moment, we find nothing to contradict the belief that parent participation in such a program as this one does strengthen the family bond.

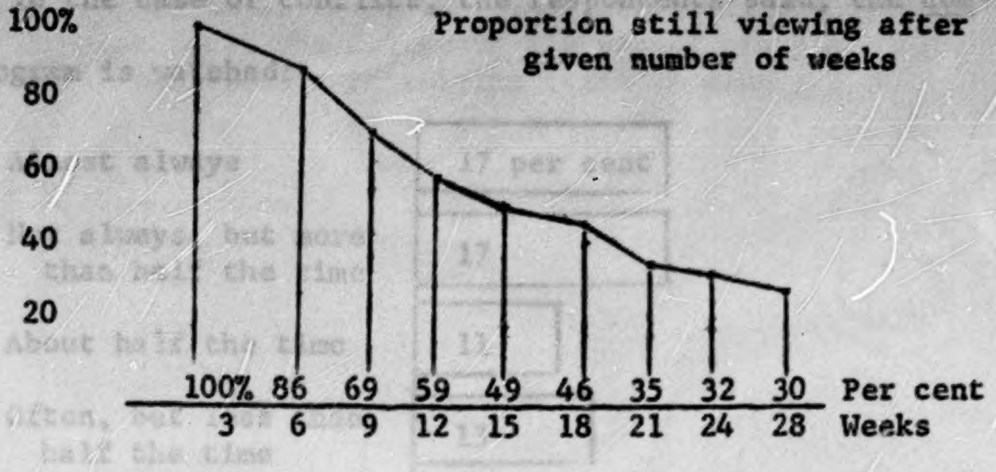
What actually went on in the participating homes?

We have several times mentioned a 200-family survey. We conducted interviews with the adults in a probability sample (n = 200) of participating families, with the intention of finding out what precisely constituted "participation" in different kinds of families, what attitudes and relationships resulted, and how student performance was related to patterns of family participation. Let us now review some of the findings that came out of that survey.

Recall that we asked parents (a) to view the repeated television lesson, (b) to practice with their children. To help them practice we gave them (c) a long-playing phonograph record of Spanish words and phrases, (d) a practice handbook, keyed to the televised lessons. What happened to each of these assignments?

Viewing

The survey was made in May, near the end of the school year. In the week before the survey, in over 50 per cent of the homes, neither child nor parent viewed any of the repeat programs. In the homes where viewing went on, that week, about half of the programs were viewed by the child alone, half with one or more parents. Only about 10 per cent of parents would admit that they had never viewed with their children, but a large number declined to answer the question; and our guess is that in perhaps 20 to 25 per cent of the "participating" families there had never been real parent participation in viewing. Throughout the year there had apparently been fairly steady attrition, as parent-viewers found other duties or interests more demanding. This curve shows the proportion of parents (at least one parent per family) who had ever viewed and who were still viewing. The points on the curve mark three-week intervals throughout the year:

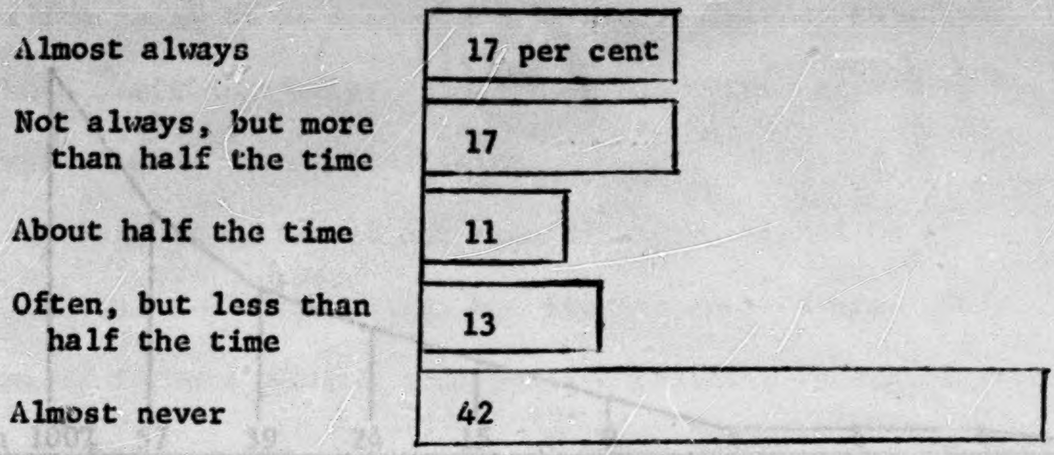


Proportion still viewing after given number of weeks

Who views with the children? Mothers, rather than fathers. In families where parents viewed any program in the week before the survey, mothers were two and a half times as likely as fathers (22% to 9%) to be the viewers. In these same homes, parents who had studied some Spanish in school were significantly (.01) more likely to view than parents who had never studied Spanish. And if a parent had attended college, he was significantly (.01) more likely to view than one who had no college. This difference is still larger and more highly significant among mothers. Therefore, it is the mothers who have had some Spanish and have been to college, who are the most faithful viewers among the participating parents.

Are there any conflicts over use of the television set which are associated with family participation? Apparently this is a fairly serious matter. Sixty-four per cent of the respondents said that the Spanish TV lesson sometimes comes at a time when someone else in the family would prefer to watch another program. What happens then?

In the case of conflict, the respondents said, the competing program is watched:



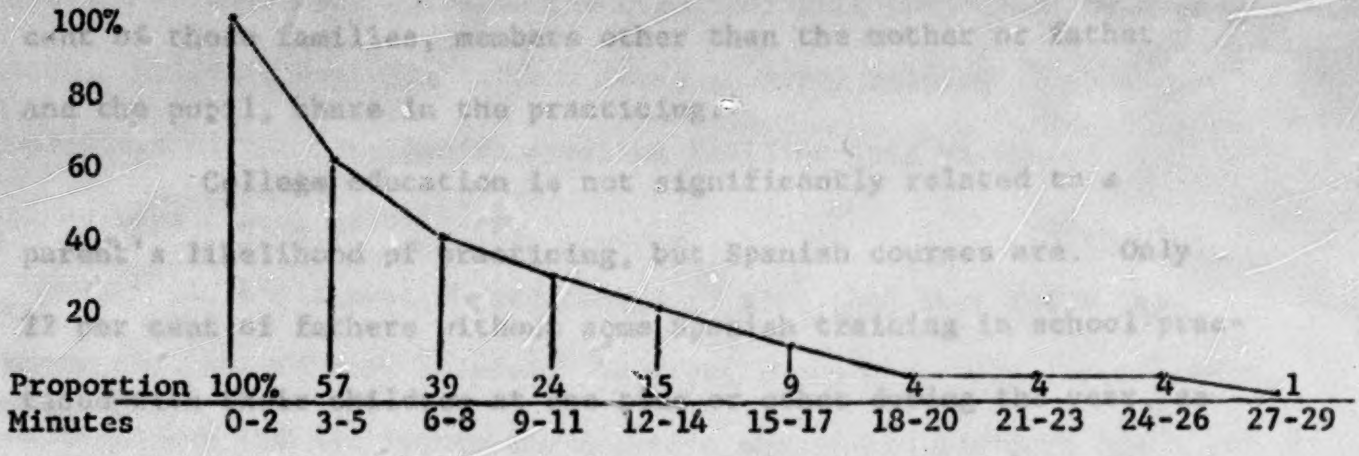
In other words, when conflict occurs over choice of programs, the Spanish lesson has better than an even chance of being viewed.

Practicing

At the time of the survey, 58 per cent of the non-Spanish speaking families said they were still practicing with the children. Twelve per cent said they had never practiced; 29 per cent, that they had once practiced, but had given it up. The figures for Spanish-speaking families are somewhat harder to interpret, because 27 per cent of the respondents declined to answer the question. The supposition is that they had not practiced; and in general the participation of the Spanish-speaking families was less than the others in practicing, as also in viewing.

How much time do they give to practice? Of those who practice, a little over 30 per cent give it only the most perfunctory attention -- less than 3 minutes a week. Only 39 per cent practice more than 5 minutes a week. Here is the curve:

Proportion of those who practice at all who spend at least the following amounts of minutes per week on practicing (time in minutes)



Who practices? The mother more often than the father, more often than both of them together. To the question, "How many of you usually practice with the child?" the answers were:

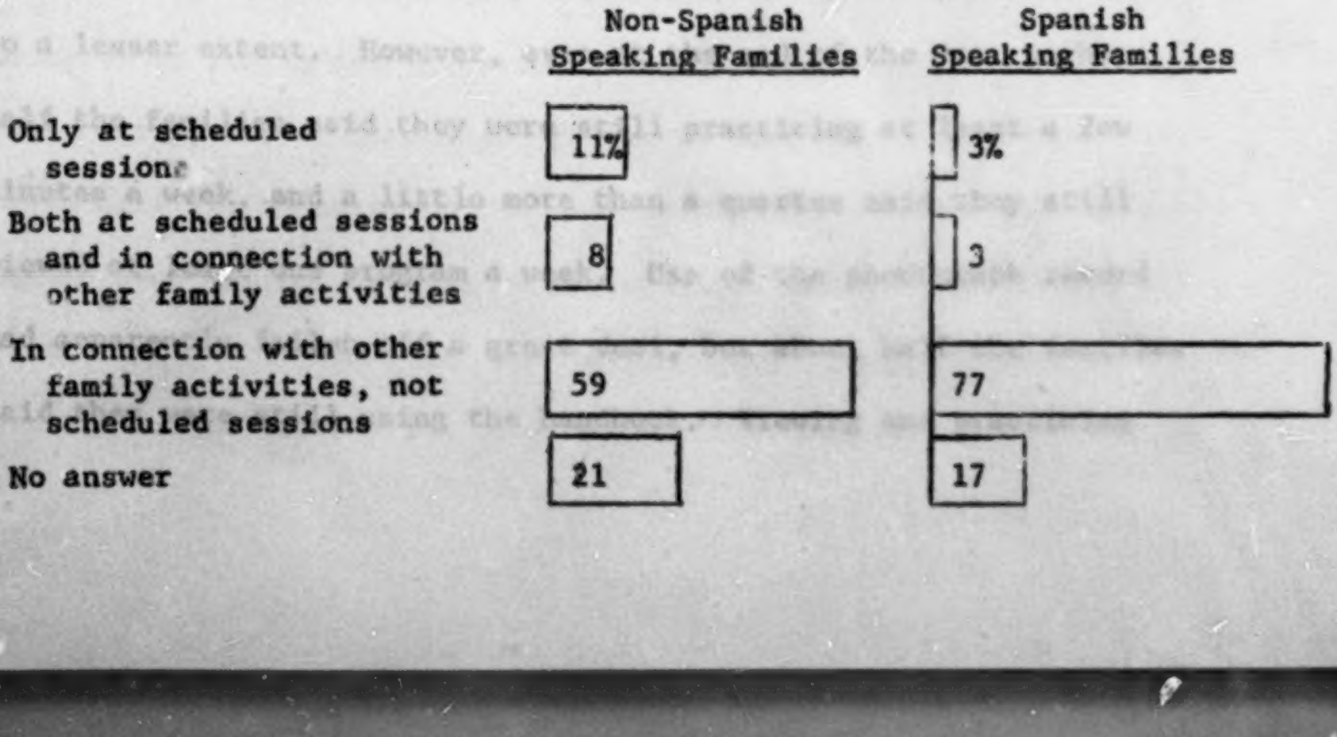
	Non-Spanish speaking families	Spanish speaking families
Mother only	36%	23%
Father only	6	10
Other members only	8	23
Mother and father	11	13
Mother and others	10	10
Father and others	2	0
Mother, father, and others	10	7
No one, or no answer	16	13
	(n = 165)	(n = 30)

So in this respect, as in viewing, the mothers typically take the principal responsibility. In the Spanish-speaking family, the responsibility seems to be somewhat more widely shared; in 40 per cent of those families, members other than the mother or father and the pupil, share in the practicing.

College education is not significantly related to a parent's likelihood of practicing, but Spanish courses are. Only 22 per cent of fathers without some Spanish training in school practiced with their children at one time or other during the year, as compared to 65 per cent of fathers who had taken Spanish. Sixty-five per cent of mothers without Spanish training, as compared to 98 per cent of those with Spanish training, practiced.

Furthermore, if a mother views with her child she is very likely also to _practice_ with the child. The probability is more than 9 in 10.

When do they practice Spanish? Overwhelmingly they combine it with other household activities, rather than scheduling specific sessions on it. Asked whether they practiced in scheduled sessions or in connection with other family activities, they answered:



The record and the handbook

Just under half of the sample (although a much higher proportion of those who answered the question) said they used the handbook. A little over 30 per cent found it "very helpful". About one-third of the non-Spanish speaking families said they used it three days a week or oftener.

A little over 30 per cent said also that they found the phonograph record very helpful. However, there were very large percentages who did not answer the question when asked how much use they made of the record, and of those who did answer 68 per cent indicated that they used it 5 minutes or less a week; 53 per cent, that they used it less than 3 minutes a week. There is good reason to believe that practice with the record fell off a great deal after the first months of the course.

Recapitulation

To recall what the survey told us of what went on in participating homes, we should record that viewing fell off steadily throughout the year, and doubtless so also did practicing, although to a lesser extent. However, even at the end of the year perhaps half the families said they were still practicing at least a few minutes a week, and a little more than a quarter said they still viewed at least one program a week. Use of the phonograph record had apparently fallen off a great deal, but about half the families said they were still using the handbook. Viewing and practicing were more likely to occur in families that did not speak Spanish than in families who did speak it. The mother was more likely than the father to take responsibility for viewing and practicing with the child, and if the mother had taken a course in Spanish in school, and had been to college, she was much more likely to participate than if she had done neither of those things.

What kinds of family participation made for higher scores in school?

Now let us try to puzzle out some of the relationships between what went on in the course of family participation and how the children of those families performed in school.

We want to know the answers, if possible, to two questions: What made parent participation effective where it was effective, and what made it less effective for Spanish-speaking families?

Of course, we had access to the test scores of the 200 pupils whose families were interviewed during the survey. Unfortunately, in this sample there were too few pupils who had taken the speaking test to let us use those data with any confidence, but we were able to compare listening comprehension test scores with our measures of family participation. We were conservative in using these participation measures. It was evident that some of the estimates were not accurate to the week or the minute; therefore to avoid making too-fine comparisons we dichotomized the chief scales of performance in terms of "high" and "low". High viewing we defined as viewing beyond the twelfth week of the first semester, which was the point at which half the parents had ceased to view with the child. High practice was defined as practice that still continued at the time of the interview, in May of 1962; somewhat more than half the parents still claimed to be practicing at that time. High use of the handbook was defined as use two or more times a week; half the parents claimed to have used the handbook twice or oftener per week. High use of the phonograph record was defined as more than five minutes per week, which was the nearest approximation to a median split. Thus we were in position to compare what pupils did in the classroom when they participated in high practice at home, as compared to what other pupils did when they had low practice -- and so forth.

The first thing that became evident was that high practice tended to go with high viewing, and that the most potent type of family participation was a combination of the two. Here is a table that illustrates the correlation of the two:

		Practice	
		Low	High
Viewing	High	14	43
	Low	29	24 *

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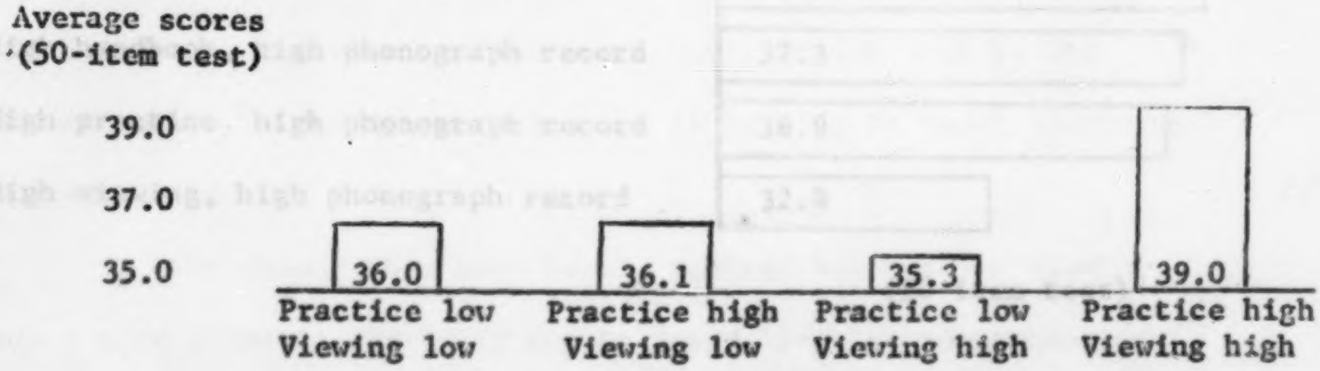
*This table gives a chi-square of 9.26, meaning such a relationship could occur by chance less than 5 in 1,000 times.

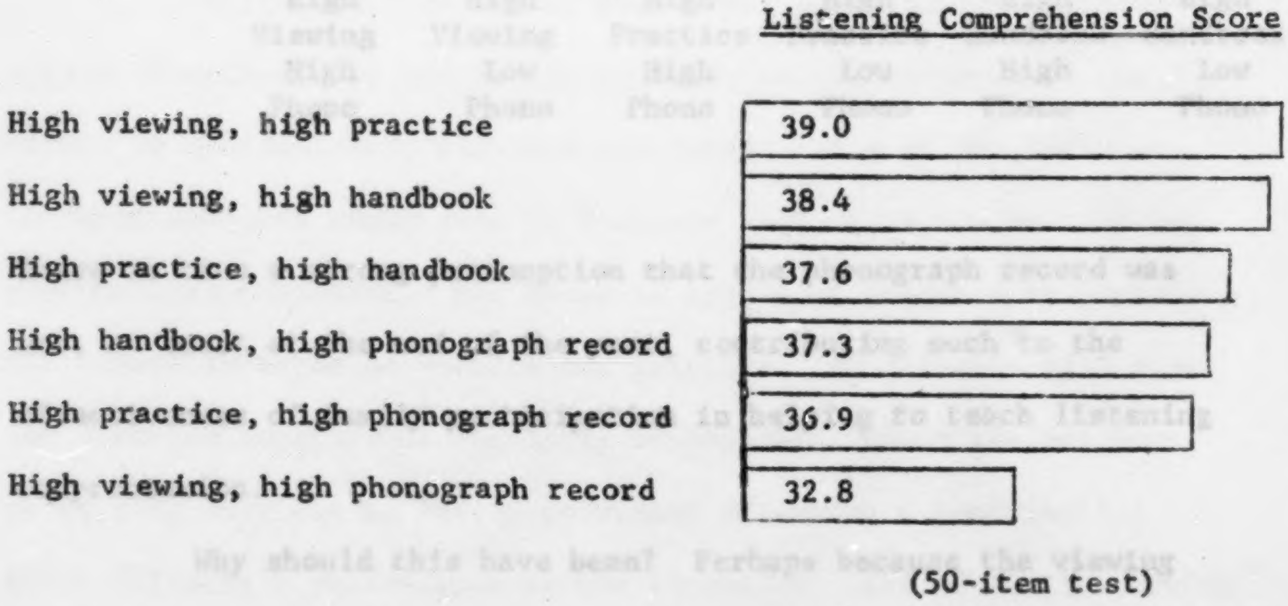
To put this in words, only one-third of those low on practice were high on viewing, whereas nearly two-thirds of those high on practice were also high on viewing. Furthermore, the two need to be combined for the most effective result. In the absence of viewing, children whose parents practice with them do not perform reliably better in the Spanish test than children whose parents do not practice with them. Similarly for viewing in the absence of practice. In short, viewing and practice both are necessary conditions for high performance in listening comprehension.

Here is the basic comparison. The figures are scores in the listening comprehension test.

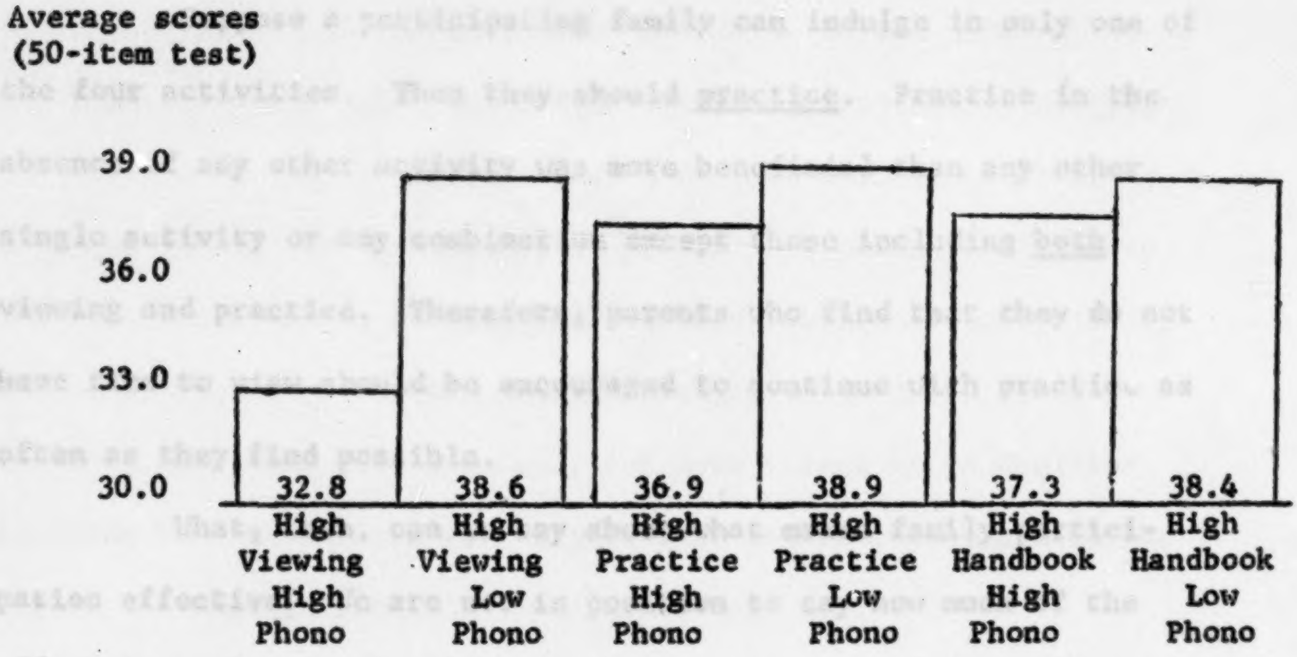


The first three scores are not significantly different, but all are significantly different from the fourth one. To make a real difference it is necessary for participation to include both high viewing and high practice.

Let us compare that with some other combinations. Almost all families that made extensive use of viewing and practice also made extensive use of the handbook. Therefore, it is not surprising to find that the scores of children who came from high-practice, high-viewing, and high-handbook homes were not significantly different from those children whose families were high on practice and viewing. Similarly, because of the high correlation of viewing and practice, the combinations of high use of any one of those with the handbook tended to be effective. Perhaps the best way to compare the effects is by pairs, thus:



Note that combinations involving the phonograph record are lowest. This lack of effectiveness of the record is even more impressive when its combinations are looked at in greater detail. In each case when high use of the phonograph is combined with high use of one of the other elements, the combination is less effective than high use of the other element alone. To illustrate:



There is thus a strong presumption that the phonograph record was not, at least at the end of the year, contributing much to the effectiveness of family participation in helping to teach listening comprehension.

Why should this have been? Perhaps because the viewing was a more dramatic and vivid way to learn language comprehension, and the dialogue practice with other members of the family was more fun. The record, if used, took time from those activities. Perhaps, also, the record made its chief contribution to proficiency in speaking the language, and pronouncing the sounds as an expert does. It is a pity that we can't test this assumption against a sufficient number of speaking test scores. Such speaking scores as we have, seem to support the idea that high use of the record may contribute to efficient speaking, but the number is far too small for the results to be reliable.

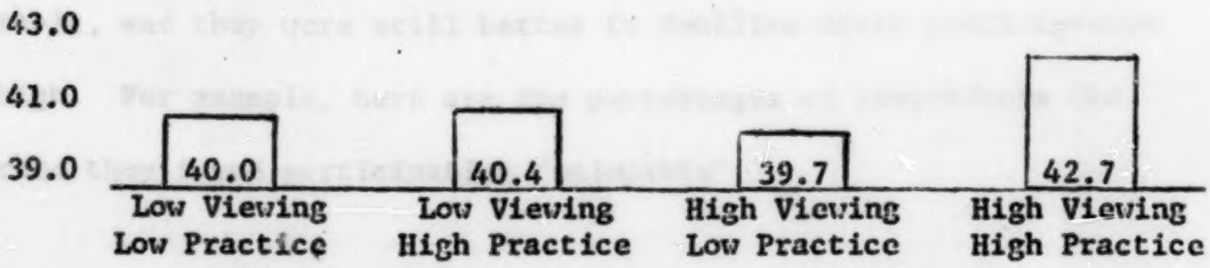
Suppose a participating family can indulge in only one of the four activities. Then they should practice. Practice in the absence of any other activity was more beneficial than any other single activity or any combination except those including both viewing and practice. Therefore, parents who find that they do not have time to view should be encouraged to continue with practice as often as they find possible.

What, then, can we say about what makes family participation effective? We are not in position to say how much of the effect is motivational, although the generalizing of the influence to other subjects would seem to indicate that there may be a strong motivational component. But there is plenty of evidence to explain the effect in terms of viewing and practice. If a family will view and practice together as regularly as possible, using the handbook as an aid, they can be fairly confident of making a contribution to their children's performance in the classroom. And if family viewing becomes too onerous, if they will merely continue to practice Spanish in connection with everyday home activities -- using such guidance as they can get, from the handbook or elsewhere -- they will make some contribution, although not as much as if they were to view and practice.

Why is family participation less effective in Spanish-speaking families?

In the preceding section we have been talking exclusively about the five-sixths of the homes in our sample where Spanish is not spoken at all or spoken only a "little". In the other 16 or 17 per cent of homes, where Spanish is spoken as a principal language, the effects of family participation are quite different. This is a puzzling thing, and the results we have do not permit us fully to explain it. However, we can easily satisfy ourselves that viewing and practice, when they are really indulged in by these Spanish-speaking families, have precisely the same effect as in English-speaking families. Here is a figure that can be compared with the figure for English-speaking families on page 135:

Listening comprehension (50 items)



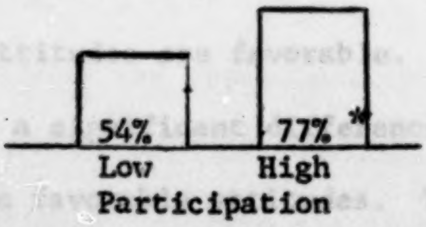
These listening comprehension means are all higher than for children of non-Spanish speaking families, but the pattern is the same: it makes a difference in the child's performance if the parents will view and practice with him.

Why, then, is family participation less effective, even counter-productive, with Spanish-speaking families? We can only guess. Is it that the "high Spanish" they sometimes hear on the television is not the localized "Mexican Spanish" they are accustomed to? Is it that the parents become impatient with the simple vocabulary, the "baby talk" they are supposed to practice? As a result, do they resist the obligation to view and practice, and develop a negative attitude toward the course which is reflected in the amount their children study? This is the most likely explanation, but unproved.

Meanwhile, we may be fairly confident of this: that if the Spanish-speaking families will view and practice, they too will find participation helpful to their children.

How are parent attitudes related to participation and to its effects?

Attitudes expressed on the parent survey were overwhelmingly favorable, and they were still better in families where participation was high. For example, here are the percentages of respondents who reported they found participation "enjoyable":



Whether the high participants were participating because they enjoyed it, or giving themselves a "pep talk" aimed at keeping up the participation, is beside the point. The point is that when we find higher participation we also tend to find more favorable attitudes.

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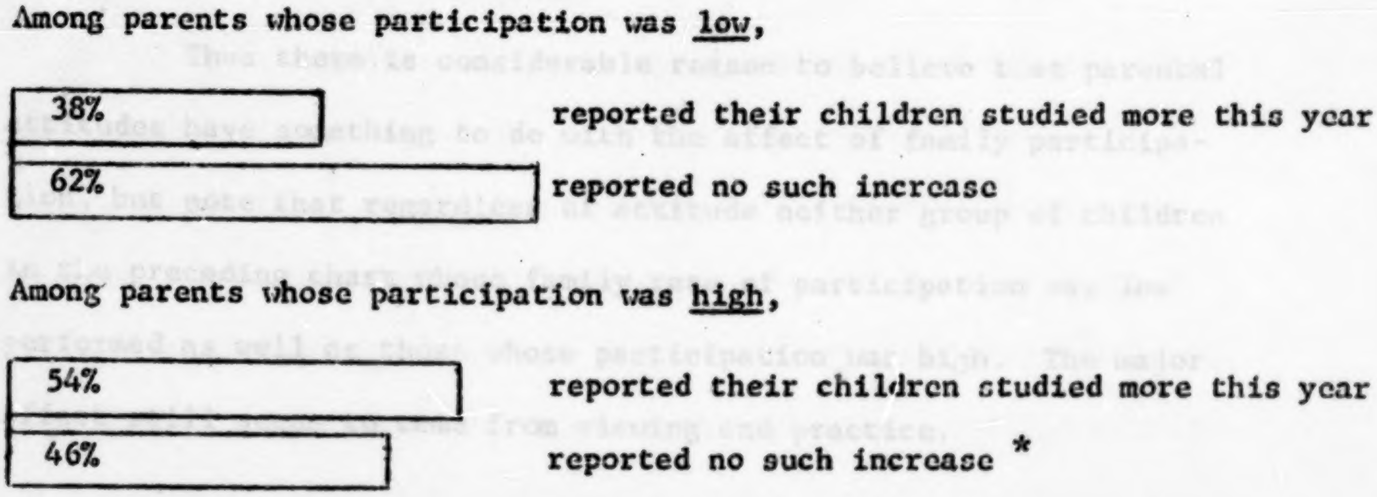
*This difference is significant (.05).

Do favorable attitudes tend to increase the child's amount of studying? This would help to explain the generalizing of effect to other courses. And the answer is that there is a trend in that direction, as this figure shows:



Does better performance by the children go with more favorable attitudes of the parents? Where family participation is high, there is a small and statistically insignificant improvement in performance when parent attitudes are favorable. When participation is low, however, there is a significant difference in favor of children whose parents hold more favorable attitudes. The following figure will illustrate the pattern. The figures are scores in the listening comprehension test.

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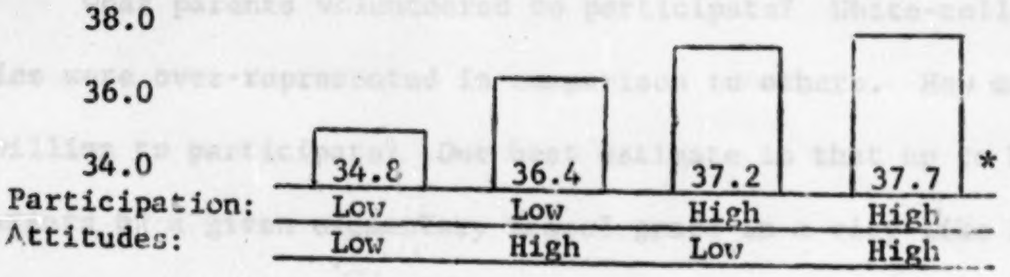
*This difference is not statistically significant, but approaches .10.



Thus there is considerable reason to believe that parental attitudes have something to do with the effect of family participation, but note that regardless of attitude neither group of children in the preceding chart whose family rate of participation was low performed as well as those whose participation was high. The major effect still seems to come from viewing and practice.

SUMMING UP

In summary, then, parent participation apparently contributes powerfully to pupils' performance if one or more of the parents will view and practice with the child. These results are very impressive, except with the approximately 17 per cent of Denver homes where Spanish is spoken most of the time. But five out of six of the fifth- and sixth-grade children are in position to benefit from parent participation. When they do get this aid, their average grades on the Spanish tests go up. Furthermore, their general grade-point average rises at a rate which is significantly different from that of children whose parents do not participate. And many parents report that the experience of home participation strengthens the family bond.

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*Significant at the .05 level.

What parents volunteered to participate? White-collar families were over-represented in comparison to others. How many were willing to participate? Our best estimate is that up to half the parents of a given elementary school grade in a city like Denver could be counted on to take part.

What actually went on in the "participating" homes? Apparently the group viewing of the repeat program fell off gradually, but about one-third of the families were still viewing in the last month of the school year. In that same month, 58 per cent claimed still to be practicing, although 61 per cent of those were practicing five minutes or less a week. Most of the practice consisted of talking Spanish in connection with everyday home activities -- very little of it at specially scheduled practice sessions. The mother was the chief participator -- especially mothers that had taken a course in Spanish in school, and had some college work.

About half the families claimed still to be using the handbook in the last month of the school year. Use of the phonograph record had fallen off considerably more than that.

Best school performance in Spanish was associated with high amounts of practice and viewing by the parents and children. The combination of these two activities seemed to be essential to a really powerful effect of home participation. In most cases the use of the handbook was associated with these other two activities. The phonograph record, however, was really counter-productive in its effect on listening comprehension grades. It may be that the record made its greatest contribution to grades on the speaking test, where the numbers within the survey sample were so small that we were unable to test. In the absence of all other home activities, practice proved to be most effective, but, of course, far less effective than a combination including both practice and viewing.

Attitudes were associated with participation. When participation was high, favorable attitudes made relatively little difference in the child's school performance; but when family participation was low, then favorable attitudes on the part of the parent made a significant difference in how well the child did in school. Favorable parental attitudes were associated with high participation, and apparently also with the amount of studying the child did. Thus, one can make a good case for the motivating effect of parental participation, but still the major effect seems to trace back to the amount of viewing and practicing that goes on in the home.

7. THE "TOMORROW'S CLASSROOM" EXPERIMENT

In the third year of research, we conducted an experiment to find out what could be accomplished by a teacher with a high level of interest, supported adequately by the teaching materials, equipment, and experience of the project, and with a free hand to choose among methods and materials.

Seven teachers were given complete freedom in conducting their sixth-grade Spanish classes. This freedom, of course, extended only to classroom instruction. All children saw the televised lessons on Tuesdays and Thursdays, and the only restriction on these classes was that they work toward the course objectives of Denver's sixth-grade Spanish. Available to each class were all the materials and tools of the project: a tape recorder, a record player, the practice phonograph records, the programmed textbooks, the workbook, the extended reading materials, and so forth. From all the resources of the course, in other words, and from any other methods and materials they could devise, these teachers were permitted to choose freely.

What happened in the seven classes, therefore, points toward "tomorrow's classroom" in Denver -- the way in which Spanish will be taught in Denver after the research project is completed. It also represents the judgment of informed teachers on the various materials and methods tried during the project.

Who were the teachers?

The teachers were not a random or even a representative sample of the teacher corps. Volunteers for this experiment were invited at the beginning of the school year, and these seven were chosen at random from about 50 who volunteered. One came from each of the seven research groups. They were not necessarily the best prepared or the most experienced teachers; indeed, one of them had never had any formal Spanish training of any kind. On the other hand, they were all highly interested, and challenged by the new assignment.

What happened in their classes?

What did they do?

For one thing, they conducted exciting classes. This is the unanimous opinion of observers. The classes were lively, the pupils were interested, the teacher's own excitement was transferred to the learners.

In the process of accomplishing this, they used a wide variety of materials. The fact that all seven came to this same decision is a matter of some note. Despite what we said in an earlier chapter, that the teacher is himself the most effective "learning aid", and despite the general feeling among teachers after a year or so of experience that the available classroom time is all too short even for teacher-directed drill -- notwithstanding these things, still every teacher opted for dividing the available time among a number of different learning activities.

Every teacher supplemented the basic televised lessons with a certain amount of teacher-directed classroom drill. Every teacher used the programmed textbooks. and the workbook (Leemos), for practice in reading and writing.* Every teacher made considerable use of electronic aids for practice in speaking and listening. There was a general conclusion that the tape recorders were more useful than the record players, because they permitted the pupil to record and hear his own spoken Spanish; and the dual-channel tape recorder was more useful than the single-channel recorder because it permitted the pupil not only to hear himself but to compare his Spanish with that of an expert speaker.

In addition to these things, every teacher employed some activities especially for motivational purposes. Some established Spanish corners in the classrooms where pictures, artifacts, books and magazines, and recorded music provided some introduction to the culture of Spanish-speaking countries. Some tried current events newspapers in Spanish. Some organized plays and programs in Spanish to which the parents were invited.

Every teacher tried also to develop means of breaking down the pupils' inhibitions against speaking the language, and to encourage the pupils to "teach each other". For this purpose, toy telephones were used in some classrooms, for pairs of pupils to converse in Spanish. Another ice-breaking device was a "Spanish table" at

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[*] They pointed out that some new materials were needed, which would be integrated more closely with the televised lessons and the programmed materials.

lunch time, at which only Spanish was spoken. Still another such device was the assignment to write and deliver "commercials" in Spanish, as though for radio or television.

For variety, stories, songs, plays, dances, displays, picture flashcards, "Spanish walks", the use of Spanish in other courses, the handing out of assignments written in Spanish -- these and other devices were used. The courses were remarkably varied, and furnished testimony both to the ingenuity of the teachers, and to the flexibility of the materials available in the course.

The significance of these variations was more than motivational or practice, however. This was the effort of the teachers to adjust their materials and methods to the different needs and abilities of their students. Classes varied considerably among schools and within schools, and students within classes. Therefore, the teachers were, in effect, individualizing their teaching and their use of available materials.

The classes were challenging -- on this all observers agreed. The students seemed to like the work. The teachers themselves were pleased by the experience. But how much did the pupils learn?

What were the effects on pupil performance?

The results were quite dramatic. The pupils of these seven sections did better than all the other sections combined at a significance level beyond .001.[*] The difference between their score and the average of all other groups on reading and writing was little less than astounding! Furthermore, they did better than the average for the best combination of methods we found in each case, and better than the average of classes where both teacher interest and preparation were high. Here are the comparisons:

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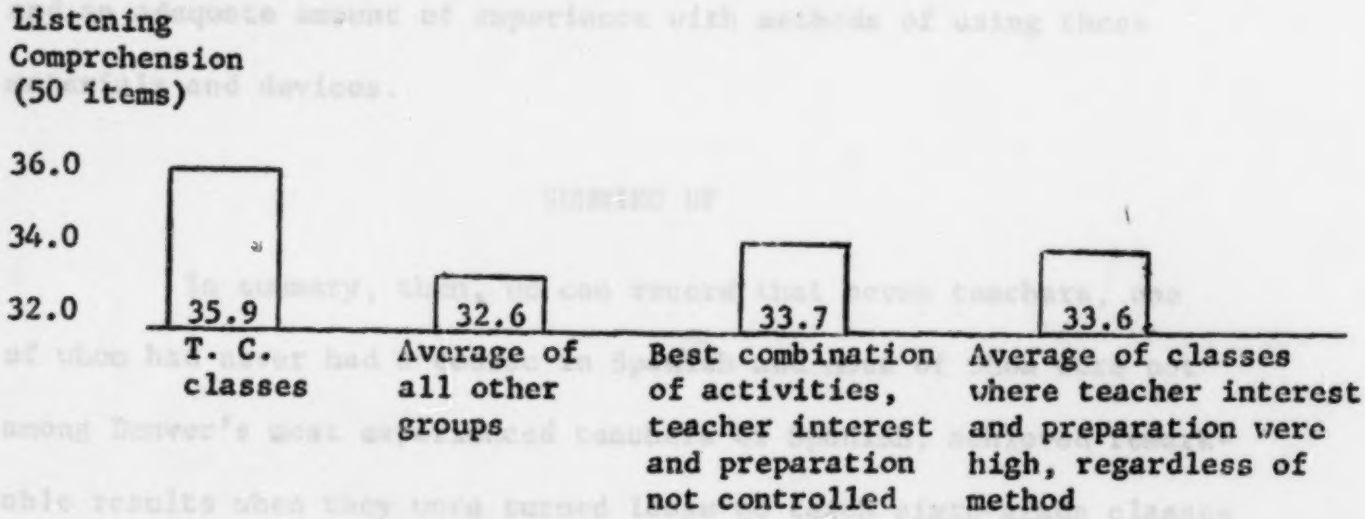
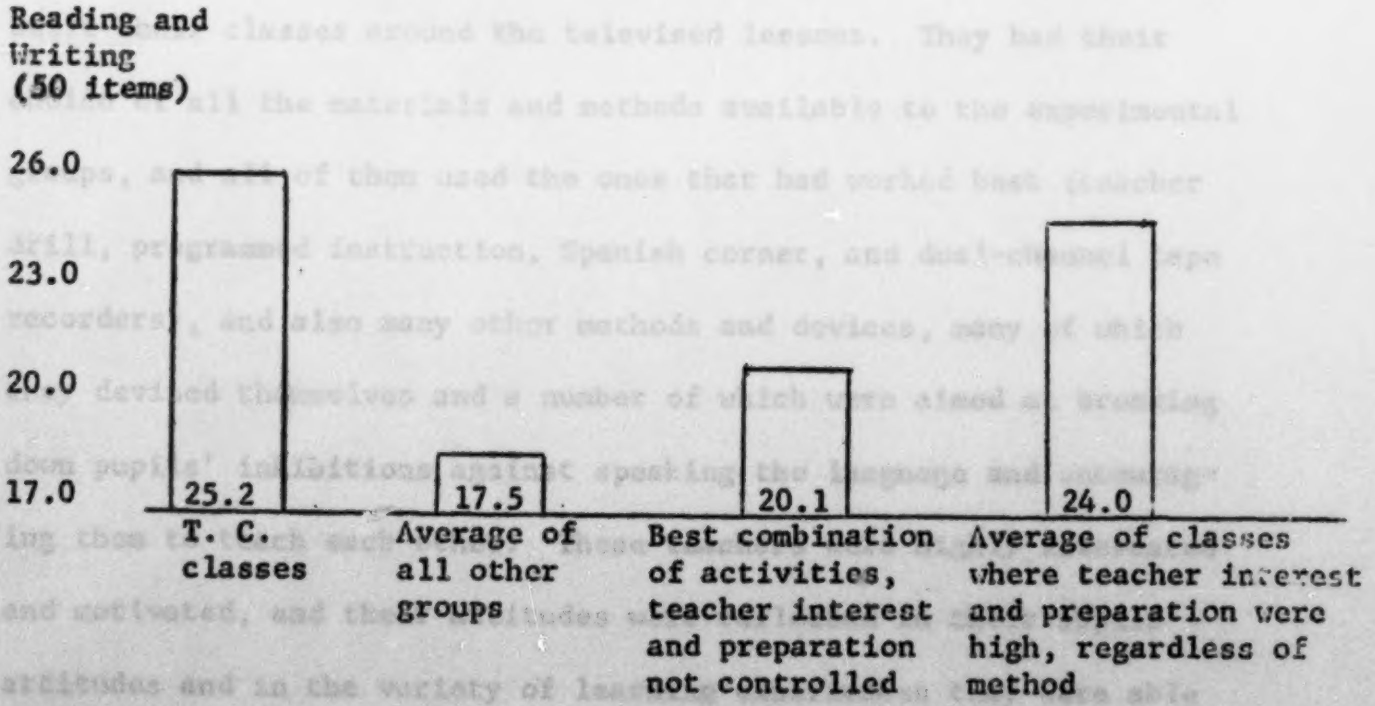
[*] For details, see Table 43.





This manifest superiority does not mean, of course, that a school system will necessarily get the most learning by turning its teachers loose to do exactly what they wish. Rather, it shows what interested teachers can accomplish with a course built around television, if they are backed up with adequate materials and equipment, and an adequate amount of experience with methods of using these materials and devices.

SUMMING UP

In summary, then, we can record that seven teachers, one of whom had never had a course in Spanish and most of whom were not among Denver's most experienced teachers of Spanish, achieved remarkable results when they were turned loose to teach sixth-grade classes as they might teach after the experiment was concluded. All of them built their classes around the televised lessons. They had their choice of all the materials and methods available to the experimental groups, and all of them used the ones that had worked best (teacher drill, programmed instruction, Spanish corner, and dual-channel tape recorders), and also many other methods and devices, many of which they devised themselves and a number of which were aimed at breaking down pupils' inhibitions against speaking the language and encouraging them to teach each other. These teachers were highly interested and motivated, and their attitudes were reflected in their pupils' attitudes and in the variety of learning experiences they were able to provide for pupils. At the end of the year, their classes scored higher than any other groups.

Thus, the "tomorrow's classroom" experiment is a forecast of what future teaching of Spanish in Denver may be, and something like a final examination on the Denver-Stanford project.

CONCLUSIONS

Thus Denver completed its search for an effective context for instructional television, in elementary school Spanish, with two simple combinations:

> For the fifth grade -- Eclectic practice conducted by the classroom teacher, practice in the classroom with an electronic aid (preferably a dual-channel tape recorder), and parent participation in viewing and practice at home.
>
> For the sixth grade -- Eclectic practice conducted by the classroom teacher, programmed instruction (as soon as the pupil is ready for it), a Spanish corner in the classroom, and parent participation in practice and viewing at home.

This will presumably be the pattern for Denver's future teaching of the course.

But the significance of these findings is wider than Denver, and we believe that the results should be encouraging to educators as well as researchers.

For one thing, it has been demonstrated that an effective context can be built for instructional television. This means not only that we have found a way to make an already effective device much more effective, but also a way for the school to play a more active part in learning from television. Instructional television, that is to say, should not be merely something piped from the outside into a school; it is something a school uses. It is part of the learning resources of a school, like books, tests, laboratories, and special teachers, which are combined into whatever package best meets a learning need. Our observation was that a subtle change took place during the course of this study in some attitudes in the Denver schools toward instructional television. At the beginning, the television lesson was something that was being *done to* the school. The teachers who were competent in Spanish rather resented having to give time to television; those who were inexperienced in Spanish either thought of it as 15 minutes imposed on them by top administration (if they were not compelled to conduct classroom practice afterward) or dreaded the end of the television (if they *did* have to conduct practice) when their lack of skill in the language would be contrasted with the facility of the television teacher. But as the superiority of the combinations became apparent, and as the inexperienced teachers gained confidence and skill, this feeling appeared to change, and many teachers began to think of television as an ally -- a part of the "team".

And needless to say the combinations *were* vastly superior. It is hard to say *how* superior. In statistical terms, the differences were significant far beyond the .001 level. In grade terms, we tried early in this report to describe one of the simplest combinations as having the effect of raising a class average 20 points over what it was when the pupils saw television alone. When the best classroom combination* and parent participation at home were added to already effective television, the results were spectacular.

In the second place, it is a matter of considerable importance to American elementary schools that even a teacher inexperienced in Spanish could learn to manage efficiently the combination of activities built around television. Foreign language in elementary school is being more widely accepted all the time. But to make every elementary schoolteacher, even those in the upper grades, expert foreign language teachers, would require an enormous training program, alarming expenditure, and perhaps many years. What Denver did, however, is feasible: shared some of its best teaching by television, and used the television to pace and present the basic material of the course; then provided inservice training opportunities, and counted on elementary schoolteachers developing the ability to manage the drill, the electronic aids, the programmed instruction, the reading, and other activities related to the television that went on in the classroom. The television itself turned out to be an inservice training device, for it showed the inexperienced teachers how experts taught the language, and how native speakers pronounced it.

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*For example, teacher-directed practice and electronic aids (with feedback) in the fifth grade; teacher-directed practice, programmed instruction, and a Spanish corner in the sixth.

The supervising teachers at Denver were amazed and pleased at how the competence of the teacher corps rose during the three years of the study. One of the teachers in the "tomorrow's classroom" experiment, whose classroom was much admired, had never had a course in Spanish, and had never taught it before the first year of this study; few observers who saw his class would believe that. Earlier we quoted the supervisors' report that teachers who had thought at first they never could fill 15 minutes of classroom practice time, now consider 15 minutes entirely inadequate. The Denver teachers are good teachers, but many of them now find themselves doing teaching they never thought they could do.

In the third place, it is of widespread significance that this experience has proved the parent can participate effectively in a course built around television. It is a temptation to generalize this finding very broadly, and say that parents can be of more help to their children with homework than they have been in recent years. This may be true, but we have not proved it. We have worked with a rather difficult field for parent participation, a field that supposedly requires methods considerably different from the language teaching most parents remember, and which places a premium on authentic pronunciation. Even so, a parent can more easily move into audio-lingual Spanish than, say, into the new mathematics of sets and number theory. Furthermore, this was a course built around open-circuit television. There is a very real question whether parent participation in this course would have been effective without the expert teacher on television to pace and model the home practice as he paced and modeled the classroom practice. This is an extra bonus of instructional television, seldom, if at all, demonstrated before. But given the evening repeat of the television, the performance of children who had the aid of family participation was most impressive. The consistent increase in test scores, the apparent generalization of this effect over the entire grade-point average of the pupil, and the many reports of improved family relations as a result of participating -- these are bound to raise the question as to how widely parent participation should be utilized.

Denver, thanks to the enthusiasm of its administrators and the liveness of its PTAs, was able to get just under half of the families of its fifth-grade Spanish pupils to volunteer. This does not seem an unreasonable goal for other school systems. A question that is bound to occur to other systems, though, is for what subjects they can best use an organized program of parent participation. We have seen that it works in elementary school Spanish, and language may be one of its most important uses. It might not work in the new mathematics. Would it work in reading? Spelling? History? This remains to be found out. But meanwhile, it is quite clear that if parents of elementary school children, guided by television and by a well-organized program, will view and practice with their children, they can contribute to their children's learning in school.

This study adds to the growing evidence that programmed instruction, of certain kinds and under suitable conditions, can be used effectively in schools. One of the impressive findings in the sixth-grade research was that practice by programmed instruction plus teacher-directed practice is better than the same amount of time devoted to either one alone. Thus programmed instruction did not serve as a substitute for the teacher, nor was it better than the teacher; but combined with teacher-drill it made a new and more potent package.

Programmed instruction also raised one of the several questions of timing that emerged from the study. Apparently a certain base of knowledge of the spoken language is necessary before the student is prepared to take off and work efficiently on his own, to learn to read and write the language. Therefore, programmed instruction was not effective for many students in the first semester of the sixth year, whereas it was highly effective in the second semester. On the other hand, there was no apparent disadvantage to listening comprehension or speaking, if reading and writing were begun in the first semester of the sixth grade, rather than the second one. This suggests that some of these questions of timing might well receive more attention and more research.

One of the useful characteristics of the project was the attempt to make the procedure possible for other schools. Elementary schoolteachers were not asked to perform miracles or transform themselves overnight. No gigantic training programs were budgeted. No special expenditures were made for electronic aids or other teaching devices. The Denver program was a do-it-yourself program, and the used effectively in schools. One of the impressive findings in the sixth-grade research was that practice by programmed instruction plus teacher-directed practice is better than the same amount of time devoted to either one alone. Thus programmed instruction did not serve as a substitute for the teacher, nor was it better than the teacher; but combined with teacher-drill it made a new and more potent package.

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And on the subject of feasibility, it should be noted that it was proved feasible to conduct a major research project, involving as many as 12,000 students and 4,000 pairs of parents a year, with a complex design of many different experimental treatments, in the classrooms of a city school system over a space of three years, without disrupting the system or lowering the effectiveness of instruction. Naturalistic research of the kind represented by this study is always difficult because on the one hand the researchers find it hard to control the variables they are dealing with, and on the other hand the need for experimental controls often interferes with the kind of instruction that teachers feel should be going on. This study demonstrated, at least to the satisfaction of the participants, that even large-scale research of this kind can be done, if there is sufficient planning and sufficient understanding, without overstepping either the limits of solid method or good instruction.

Let us reflect for a moment on the characteristics of the instruction that proved most effective in this study, and are perhaps most likely to be generalized to other televised courses.

For one thing, the Denver pattern emphasized a very _active_ kind of learning. Beginning with the many active responses encouraged by the television program, through the classroom drill, the individual practice with electronic aids and programmed instruction, to the family practicing Spanish as they wash the dinner dishes, the pupils are kept busy and active practicing responses. They are not permitted to be passive for long. Furthermore, for a large part of the time they are kept busy _teaching themselves_, or _teaching each other_. The programmed instruction and electronic aids are used mostly as self-teaching; devices like the Spanish corner are partly self-teaching, partly group teaching; and one of the barriers the laissez-faire teachers worked hardest to surmount was the pupils' inhibition against speaking the language to each other. Therefore, the Spanish table, the Spanish walks, the telephone conversations, the Spanish plays, were all devices by which pupils could teach each other.

The kind of instruction that worked best in Denver's elementary school Spanish depended heavily on involvement on the part of the pupils, interest on the part of the teachers. One of the most revealing passages in this report describes what happened when a few classes were given a program to study in a poorly built, unreliable teaching machine that kept breaking down. The pupils kept repairing the machine, in fact became highly ingenious at doing so. The teachers fumed at the amount of time that was being wasted, but when the scores were in, the classes with the balky teaching machine did better than any other groups. Why? Apparently because the pupils became involved: it was their machine, they had kept it going, they wanted to justify it. Ingenious school systems will, let us hope, devise something better than a balky and inefficient teaching machine to arouse the same degree of involvement.

Even more significant is the part that teacher interest seems to play. In fact, the whole study -- which was expected by some to downgrade the classroom teacher in favor of television, programmed instruction, parent help, and so forth -- actually made the classroom teacher seem more important than ever. The great difference in pupil performance related to teacher preparation and experience, for example, and the fact that teacher preparation and experience were reflected fully as much in pupils' individual practice as in their classroom practice -- these are far from suggesting that the teacher is unimportant in a team activity like the one at Denver. But the real surprise was the apparent importance of teacher interest. The table on page 62 is worth looking at again. It indicates that if teacher interest is low, then even high preparation and experience will not make for very high levels of pupil performance. It is the combination of high interest and high proficiency that makes the difference. This is clearly what happened in the case of the laissez-faire teachers. Some of them did not score in the highest third of the preparation and experience scale, but all of them were highly interested and challenged by their assignment. Their drive and enthusiasm were reflected in the kinds of opportunities they were able to provide for pupils and in their pupils' performance.

Finally, the pattern that emerged at Denver is, in the best sense, a team pattern, applied to one subject rather than the whole curriculum. The underlying principle seemed to be that a member of the team was most effective doing what he was best prepared to do. The television teacher was best at conducting a brilliant, active class for the whole grade. The classroom teacher, if he were very skillful, was effective at conducting oral drill; if he were not skillful at that, he might be skillful enough to supervise effectively the pupils' practice with electronic aids. The parent was most effective at motivating the child by viewing with him, and giving him a little extra practice by talking Spanish with him in connection with everyday events at home. Another member of the team, in the best sense, was the teacher who constructed the programmed instruction materials: through these materials he served as a kind of tutor for the entire sixth grade. And also on the team was the central staff, which prepared materials, conducted training sessions, and helped meet problems. The responsibility was thus divided, although the classroom teacher had the central responsibility for building the context of the television. And one of the most important findings of the "tomorrow's classroom" experiment was that the classroom teacher could individualize the use and combination of methods and materials available to him, so as to fit them to wide variations in student interest and abilities. This is an essential part of providing an efficient "context" for instructional television.

Undoubtedly the team concept could be extended further. The findings in this study that, whereas teacher drill works better in small classes, individual activities like programmed instruction work as well or better in large classes, suggest that any school large enough to have several classes in the same grade might conceivably use large classes for television and individual practice, and small ones for oral drill, and thus make a more efficient use of teachers' time.

No one believes that we have found the best form of the team or the best context for all instructional television. But we have found a very good team pattern, and a context that greatly multiplies the effectiveness of televised teaching. Some of the characteristics of the Denver context will doubtless reappear wherever television is brought effectively into the classroom.

9. APPENDIX

A. THE GENERAL DESIGN

At the beginning of the research, the following general hypotheses were stated:

Certain kinds of instructional television, combined with certain kinds of home and classroom reinforcements, make for more learning, ceteris paribus, than other kinds and combinations.

Instructional television of a certain kind, reinforced by certain classroom activities, makes for more learning, ceteris paribus, than without this reinforcement.

Instructional television of a certain kind, reinforced by certain home activities, makes for more learning, ceteris paribus, than without this reinforcement.

Instructional television of a certain kind, reinforced by certain home and classroom activities, makes for more learning, ceteris paribus, than without these reinforcements or with either one alone.

Such hypotheses, translated into practical school problems, call for multivariate analysis. Of the several forms available, covariance suggested itself. For logistic reasons, if for no other, it seemed reasonable to make the analysis in two stages, first sorting out the main effects from the families of independent variables (including presentation variables, formal practice variables, and informal practice variables), and then combining these main effects in various forms. Testing n independent variables of this kind require n experiments on a paradigm similiar to that on the following page.

PARADIGM I. Covariance Design for First Stage Hypotheses.

	I_1^i		I_2^i		$\ldots\ I_n^i$	
M_1^i	x_{11}^i	y_{11}^i	x_{12}^i	y_{12}^i	x_{1n}^i	y_{1n}^i
	x_{21}^i	y_{21}^i	x_{22}^i	y_{22}^i	x_{2n}^i	y_{2n}^i
	...	...	...	...	...	...
	...	...	...	...	...	...
	x_{m1}^i	y_{m1}^i	x_{m2}^i	y_{m2}^i	x_{mn}^i	y_{mn}^i
M_2^i	...	...	...	...	...	...
	...	...	...	...	...	...
	x_{M1}^i	y_{M1}^i	x_{M2}^i	y_{M2}^i	x_{Mn}^i	y_{Mn}^i

Where: y^i are observations on dependent variables of oral vocabulary ability and conversation ability; and

x^i are observations of variables of IQ, school marks, and age; and,

I^i are independent variables of presentation mode, form of practice, and reinforcement of learning; and

M^i are mediating variables of sex, previous language experience (out of school), home background, motives to learn, attitudes toward schooling, language (Spanish), and teacher.

By this work it would be possible to identify the independent variables which have significant effects and combine them in various combinations. The paradigm for this second stage would be of this form:

PARADIGM II. Covariance Design for Second Stage Hypotheses.

I^1:	1	1	1	1	2	2	2	2
I^2:	1	1	2	2	1	1	2	2
I^3:	1	2	1	2	1	2	1	2
M_1^i	x^i_{11} y^i_{11}	x^i_{12} y^i_{12}	x^i_{13} y^i_{13}	x^i_{14} y^i_{14}	x^i_{15} y^i_{15}	x^i_{16} y^i_{16}	x^i_{17} y^i_{17}	x^i_{18} y^i_{18}
	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...
	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...
	x^i_{n1} y^i_{n1}	x^i_{n2} y^i_{n2}	x^i_{n3} y^i_{n3}	x^i_{n4} y^i_{n4}	x^i_{n5} y^i_{n5}	x^i_{n6} y^i_{n6}	x^i_{n7} y^i_{n7}	x^i_{n8} y^i_{n8}
M_2^i	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...
	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...
	x^i_{N1} y^i_{N1}	x^i_{N2} y^i_{N2}	x^i_{N3} y^i_{N3}	x^i_{N4} y^i_{N4}	x^i_{N5} y^i_{N5}	x^i_{N6} y^i_{N6}	x^i_{N7} y^i_{N7}	x^i_{N8} y^i_{N8}

Where: y^i are observations on dependent variables of oral vocabulary ability and conversation ability (for fifth grade students) and written vocabulary, ability to write language, and ability to read language (for sixth grade students who had language in fifth grade).

x^i are observations on variables of IQ, school grades, age -- and for second year language students: observations on oral vocaublary ability and conversation ability from previous year.

I^1, I^2, I^3 are chief main effects from among the tested presentation modes, forms of practice, and reinforecements of learning. (The symbols of "1" and "2" indicate the combinations of these three main effects which will yield tests of interaction.)

M^i are mediating variables of sex, previous language experience (out of school), home background, motives to learn, attitudes toward schooling, language, and teacher, and exposure to previous experimentation.

It was apparent from the first that this research would require:

1) Large numbers of experimental subjects. (Fortunately, Denver has about 6,000 pupils in Spanish in each grade each year.)

2) Lengthy and laborious statistical work, which could be shortened by programming much of it for a computer. (This was done, and made an enormous saving of time.)

3) An informed choice of independent variables, because it would be impossible to test everything. Therefore, the research would have to start with the "state of the art"; it would be necessary for teachers, consultants, and the researchers themselves to identify the most promising forms for testing, and perhaps to perform some preliminary research before cranking one of the forms into a major experiment.. (This indeed proved necessary.)

4) Parallel activities in preparation and experimentation. (If anything, we underestimated the task of preparing television recordings, preparing programmed instruction, making special tests, and so forth, which were necessary before the research could go on.)

B. TABLES ON THE TWO TELEVISION PRESENTATION STUDIES

Table 1

RESULTS OF FIRST PRESENTATION STUDY, 1960

A) COVARIANCE ANALYSIS

Source of Variation	Residual		
	DF	Sums of Squares	Mean Square
Total	508	32,543.086	
Within Groups	506	32,281.063	63.797
Between Groups	2	262.023	131.012

$$F = \frac{131.012}{63.797} = 2.054$$

$n_1 = 2$ $n_2 = 506$ $P = .075$ (approx.)

B) ADJUSTED GROUP MEANS, LISTENING COMPREHENSION

Group	Lecture Only	Overt Response	Response and Peer-group Models	Total
Mean	50.459	49.258	50.921	50.177
(N)	(194)	(176)	(144)	(514)

Table 2

RESULTS OF SECOND PRESENTATION STUDY, 1962

A) COVARIANCE ANALYSIS

Listening Comprehension				Speaking			
ource of ariation	DF	Residual Sums of Squares	Residual Mean Square	Source of Variation	DF	Residual Sums of Squares	Residual Mean Square
otal	869	22,330.179		Total	103	8,073.733	
ithin roups	866	22,195.044	25.629	Within Groups	100	7,670.042	76.700
etween roups	3	135.135	45.045	Between Groups	3	403.691	134.564

Listening Comprehension:

$$F = \frac{45.045}{25.629} = 1.758$$

$n_1 = 3 \qquad n_2 = 866$

$P > .05$ (F of 2.60 required for .05)

Speaking:

$$F = \frac{134.564}{76.700} = 1.754$$

$n_1 = 3 \qquad n_2 = 100$

$P > .05$ (F of 2.70 required for .05)

B) ADJUSTED GROUP MEANS

Dependent Variable	Presentation Mode Group				
	Lecture Only (1)	Overt Response (2)	Studio Models (3)	Response And Models (4)	Total
Listening Comprehension	20.455	20.306	19.215	20.248	20.131
(N)	(153)	(300)	(143)	(277)	(873)
Speaking	36.033	39.437	37.701	34.511	36.991
(N)	(18)	(36)	(19)	(34)	(107)

C) ADJUSTED GROUP MEANS FOR THE TEST OF INCIDENTAL LEARNING

Dependent Variable	Research Group				
	Lecture Only (1)	Overt Response (2)	Studio Models (3)	Response And Models (4)	Total
Listening Comprehension	.471	.887	.510	.609	.664

D) SIGNIFICANCE OF DIFFERENCES BETWEEN GROUPS ON TESTS OF INCIDENTAL LEARNING

Groups	Difference	σ_{D_M}	CR	P
(2) - (1)	.416	.077	5.403	< .001
(2) - (3)	.377	.080	4.713	< .001
(2) - (4)	.278	.069	4.029	< .001
(4) - (1)	.138	.073	1.890	< .06
(4) - (3)	.099	.076	1.303	> .10

C. TABLE ON STUDY OF EFFECT OF CLASSROOM SEATING POSITION

Table 3

RESULTS OF EXPERIMENT ON CLASSROOM POSITION

A) COVARIANCE ANALYSIS

Listening Comprehension				Speaking			
Source of Variation	Residual			Source of Variation	Residual		
	DF	Sums of Squares	Mean Square		DF	Sums of Squares	Mean Square
Total	574	16,663.124		Total	66	6,337.654	
Within Groups	572	16,639.554	29.090	Within Groups	64	5,641.482	88.148
Between Groups	2	23.570	11.785	Between Groups	2	696.172	348.086

$$F = \frac{11.785}{29.090} = 0.405 \qquad\qquad F = \frac{384.086}{88.148} = 3.949$$

$n_1 = 2 \quad n_2 = 572 \qquad\qquad n_1 = 2 \quad n_2 = 64$

$P > .50 \qquad\qquad P < .03$

B) ADJUSTED MEANS ON SPEAKING TEST, BY SEATING POSITION

Position	Center Cone	Back	Side	Total
Mean	39.961	42.230	34.211	37.671
(N)	(24)	(13)	(33)	(70)

D. TABLES ON THE FIRST YEAR'S RESEARCH

To simplify the tables, experimental groups in the first year are identified as follows:

Group Number	Televised lesson in classroom, plus:
x	Nothing (televised lesson only)
1	A second TV viewing at night
2	Dialogue practice in the classroom
3	Structure practice in the classroom
4	Eclectic practice in the classroom
5	A second TV viewing at night and parent participation
6	A second TV viewing at night plus dialogue practice in the classroom
7	A second TV viewing at night plus structure practice in the classroom
8	A second TV viewing at night plus eclectic practice in the classroom
9	A second TV viewing at night and parent participation plus dialogue practice in the classroom
10	A second TV viewing at night and parent participation plus structure practice in the classroom
11	A second TV viewing at night and parent participation plus eclectic practice in the classroom

TABLE 4. RESULTS OF THE FIRST SEMESTER MIDTERM EXAMINATION

A) ADJUSTED GROUP MEANS

Group	x	1	2	3	4	5	Total
Mean	26.909	29.448	33.499	33.519	33.914	32.341	31.609
(N)	(294)	(294)	(294)	(294)	(294)	(294)	(1764)

B) COVARIANCE ANALYSIS*

Source of Variation	Residual		
	DF	Sums of Squares	Mean Square
Total Groups	1757	73,319.270	
Within Groups	1752	61,497.260	35.101
Difference (Between Groups)	5	11,822.010	2,364.402

$$F = \frac{2,364.402}{35.101} = 67.359$$

$n_1 = 5$ $n_2 = 1752$

$P < .001$

C) ADJUSTED GROUP MEANS AND VARIANCES

Group	x	1	2	3	4	5	Total
Group Mean	26.909	29.448	33.499	33.519	33.914	32.341	31.609
Group Variance	54.549	60.009	55.935	45.937	48.726	45.937	51.880

D) SIGNIFICANCE OF DIFFERENCES BETWEEN GROUP MEANS

Groups	Difference	σ_{D_M}	CR	P
1 - x	2.539	.624	4.068	$< .001$
5 - 1	2.893	.600	4.821	$< .001$
2 - 5	1.158	.588	1.969	$= .049$
3 - 2	0.020	.588	0.034	$> .400$
4 - 2	0.415	.596	0.696	$> .200$
4 - 3	0.395	.567	0.696	$> .200$

---

* By a series of multiple correlations, the possible control variables for this first analysis were reduced to IQ, grade point average, and four measures of the Stanford Achievement Scores (paragraph meaning, word meaning, spelling, and language). These si were used in the first analysis. On the basis of experience and further correlations i this analysis, it was found possible to reduce the control variables to IQ, grade point and paragraph meaning, for the other analyses in the first and succeeding years.

TABLE 5. RESULTS OF THE FIRST SEMESTER FINAL EXAMINATION

A) UNADJUSTED GROUP MEANS

Group	x	1	2	3	4	5	Total
Mean	30.491	33.087	37.497	38.484	38.797	35.535	35.644
(N)	(289)	(289)	(286)	(287)	(290)	(288)	(1729)

B) COVARIANCE ANALYSIS

Source of Variation	Residual		
	DF	Sums of Squares	Mean Square
Total Groups	1725	114,224.232	
Within Groups	1720	97,016.748	56.405
Difference (Between Groups)	5	17,207.484	3,441.496

$$F = \frac{3,441.496}{56.405} = 61.014$$

$$n_1 = 5 \qquad n_2 = 1720$$

$$P < .001$$

C) ADJUSTED GROUP MEANS AND VARIANCES

Group	x	1	2	3	4	5	Total
Group Mean	30.455	33.020	37.895	38.646	39.007	34.868	35.644
Group Variance	85.340	80.222	70.259	66.799	58.821	62.836	79.819

D) SIGNIFICANCE OF DIFFERENCES BETWEEN GROUP MEANS

Groups	Difference	σ_{D_M}	CR	P
1 - x	2.565	.756	3.392	$< .001$
5 - 1	1.848	.704	2.625	$= .008$
2 - 5	3.027	.680	4.451	$< .001$
3 - 2	0.751	.691	1.086	$> .100$
4 - 2	1.112	.669	1.662	= .048* = .097*
4 - 3	0.361	.659	0.547	$> .200$

* P = .048 on a one-tailed test
P = .097 on a two-tailed test

TABLE 6. RESULTS OF THE SECOND SEMESTER FINAL EXAMINATION

A) ONE-DIMENSIONAL COVARIANCE ANALYSES, WITH AND WITHOUT THE FIRST SEMESTER FINAL USED AS A CONTROL VARIABLE*

With the January Test

ource of ariation	Residual Degrees of Freedom	Residual Sum of Squares	Residual Mean Square
otal	1997	25,509.556	
ithin roups	1987	23,975.051	12.066
etween roups	10	1,534.505	153.451

$$F = \frac{153.451}{12.066} = 12.718$$

$p < .001$

Without the January Test

Source of Variation	Residual Degrees of Freedom	Residual Sum of Squares	Residual Mean Square
Total	1998	84,469.610	
Within Groups	1988	78,502.071	39.488
Between Groups	10	5,967.539	596.754

$$F = \frac{596.754}{39.488} = 15.112$$

$p < .001$

---

* When the first semester final is used as a control variable, the analysis reflects only the learning during second semester.

B) UNADJUSTED MEANS, MEANS ADJUSTED FOR THE FIRST SEMESTER TEST, AND GROUP VARIANCES

Group	Unadjusted Mean	Mean Adjusted for January Test	Variance	(N)
1	27.901	32.057	57.520	(91)
2	34.120	35.251	58.327	(166)
3	35.519	35.709	57.556	(210)
4	36.062	36.075	39.143	(161)
5	34.802	33.001	40.839	(116)
6	35.066	34.830	53.774	(272)
7	35.575	35.472	50.790	(274)
8	35.572	35.503	51.598	(291)
9	37.116	36.464	34.492	(138)
10	36.671	36.218	35.004	(149)
11	36.627	35.671	39.080	(134)
Total	35.283	35.283	51.529	(2002)

C) SIGNIFICANCES OF DIFFERENCES BETWEEN MEANS, WHEN ONLY SECOND SEMESTER LEARNING IS REFLECTED*

Groups Compared	Difference	σ_{D_M}	Critical Ratio	Probability
2 - 6	.421	.741	.568	> .50
3 - 7	.237	.678	.350	> .50
4 - 8	.572	.648	.883	> .35
9 - 2	1.213	.775	1.565	= .12
10 - 3	.509	.713	.714	> .40
4 - 11	.404	.731	.553	> .50
11 - 5	2.670	.802	3.329	< .001
6 - 1	2.773	.991	2.798	< .01
5 - 1	.944	.817	1.155	= .13**
2 - 5	2.250	.838	2.685	< .008
3 - 2	.458	.790	.580	> .30
4 - 2	.824	.771	1.069	= .14**
7 - 6	.642	.619	1.037	> .20
8 - 6	.673	.612	1.100	> .20
9 - 10	.246	.696	.353	> .50
9 - 11	.793	.736	1.077	> .25

** One-tailed test

D) GROUP MEANS REFLECTING LEARNING FOR THE WHOLE YEAR

Group	1	2	3	4	5	6	7	8
Mean	28.117	35.178	35.807	35.804	33.141	35.028	36.058	35.980

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*An additional two-dimensional analysis of covariance was done, comparing classroom practice and evening activities. When the types of evening activities were combined there was no significant effect of different types of classroom practice. When types of classroom practice were combined, however, then there was a significant effect of different evening activities.

E) SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS, WHEN LEARNING FOR THE WHOLE YEAR IS REFLECTED

Groups Compared	Difference	σ_{D_M}	Critical Ratio	Probability
5 - 1	5.024	.817	6.149	$< .001$
2 - 5	2.037	.838	2.431	$= .015$
3 - 2	.629	.790	.796	$> .20$
4 - 2	.626	.771	.812	$> .20$
7 - 6	1.030	.619	1.664	$= .047$*
8 - 6	.952	.612	1.556	$= .060$*
7 - 8	.078	.602	.130	$> .50$

* One-tailed test

TABLE 7. RESULTS OF THE TEST OF SPEAKING ABILITY

A) GROUP MEANS ON SEPARATE PARTS OF THE TEST

Group	Test Part			
	Phonetic Accuracy	Structure	Fluency	Total
1	17.60	1.48	4.18	23.26
2	18.33	2.30	8.98	29.61
3	18.85	2.56	8.33	29.74
4	18.98	2.55	9.60	31.13
5	19.22	2.41	6.29	27.93
Total	18.60	2.26	7.48	28.34

B) CRITICAL RATIOS AND SIGNIFICANCE OF DIFFERENCES BETWEEN GROUP MEANS, BY PARTS OF THE TEST

Groups	Test Part			
	Phonetic Accuracy	Structure	Fluency	Total
2 - 1	1.21	2.00*	3.17**	3.19**
3 - 1	2.09*	2.93**	3.53***	3.99***
4 - 1	2.28*	2.90**	3.76***	4.33***
3 - 2	1.33	0.62	0.39	0.13
4 - 2	1.62	0.60	0.33	0.81
5 - 1	2.95**	2.62**	2.08*	3.30***
4 - 5	0.77	0.39	2.24	1.83
3 - 5	1.23	0.41	1.67	1.12
2 - 5	2.82**	0.27	1.74	0.78
4 - 3	0.33	0.01	0.80	0.78

* $P < .05$
** $P < .01$
*** $P < .001$

TABLE 8. AVERAGE PROPORTION OF PROGRAMS WATCHED AND CORRELATION BETWEEN PROPORTION WATCHED AND TEST SCORE, DURING THE SECOND SEMESTER

Group	Per cent of Programs Watched	Correlation
Evening Viewing	47.42%	.201
Parent Help	60.46	.256
Evening Viewing + Classroom Practice	49.01	.254
Parent Help + Classroom Practice	60.38	.082

TABLE 9. FOURTH AND FIFTH GRADE ACADEMIC AVERAGES, STANDARD DEVIATIONS, AND VARIANCES, FOR STUDENTS WHO HAD AND STUDENTS WHO DID NOT HAVE PARENT PARTICIPATION IN THE FIFTH GRADE

Group	Grade in School	Academic Average	σ	σ^2	(N)
Parent	Fourth	3.159	.685	.469	(228)
	Fifth	3.225	.705	.497	
Non-Parent	Fourth	2.875	.770	.593	(1229)
	Fifth	2.804	.748	.560	

Correlation between fourth and fifth grade academic averages: $r_{4.5}$ = .796
C.R. group differences = 4.152 $P < .001$

E. TABLES ON THE SECOND YEAR'S RESEARCH

To simplify the tables, the experimental groups in the second year are identified as follows:

Group Number	Televised lesson plus eclectic classroom practice under direction of teacher plus:
	Fifth Grade
1	Nothing (only television plus classroom drill)
2	Practice with electronic aids in classroom
3	Second viewing in evening
4	Electronic aids plus second viewing
	Sixth Grade
	(Groups 5 through 10 began study of reading and writing in first semester of sixth grade)
5	Programmed instruction (Program form I) plus electronic aids in classroom
6	Programmed instruction (Form I) without electronic aids
7	Programmed instruction (Form A) with electronic aids
8	Programmed instruction (Form A) without electronic aids
9	Teacher-directed drill on reading and writing with electronic aids
10	Teacher-directed drill on reading and writing without electronic aids
11	Teacher-directed drill on reading and writing with electronic aids, with programmed instruction
	(Groups 12 through 18 began study of reading and writing in second semester of sixth grade)
12	Same treatment as 5, except for start of reading and writing
13	Same treatment as 6, except for start of reading and writing
14	Same treatment as 7, except for start of reading and writing
15	Same treatment as 8, except for start of reading and writing
16	Same treatment as 9, except for start of reading and writing
17	Same treatment as 10, except for start of reading and writing
18	Same treatment as 11, except for start of reading and writing

TABLE 10. RESULTS OF FIRST SEMESTER TESTS, FIFTH GRADE, BY DIFFERENT TREATMENT GROUPS

A) COVARIANCE ANALYSIS, LISTENING COMPREHENSION TEST

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	1625	89,442.992	
Within Groups	1622	89.342.902	55.082
Between Groups	3	100.090	33.363

$$F = \frac{33.363}{55.082} = 0.606$$

$$n_1 = 3 \qquad n_2 = 1622$$

$$P > .30$$

B) UNADJUSTED TEST MEANS AND MEANS OF CONTROL VARIABLES, LISTENING COMPREHENSION TEST

Variable	Group				
	1	2	3	4	Total
Test	36.027	36.463	35.951	35.954	36.098
PM	5.331	5.296	5.279	5.123	5.257
GPA	2.675	2.725	2.681	2.546	2.657
IQ	103.568	105.569	102.507	101.637	103.312
(N)	(407)	(404)	(408)	(410)	(1629)

C) ADJUSTED TEST MEANS, STANDARD DEVIATIONS, AND VARIANCES, LISTENING COMPREHENSION TEST

Variable	Group			
	1	2	3	4
Test	35.903	36.020	35.974	36.491
σ	9.245	7.736	8.293	8.143
σ^2	85.470	59.846	68.774	66.308

D) MEANS, STANDARD DEVIATIONS, AND VARIANCES, TEST OF SPEAKING ABILITY

Variable	Group			
	1	2	3	4
Mean	6.913	7.663	7.875	7.550
σ	2.797	2.020	2.146	2.539
σ^2	7.823	4.080	4.605	6.447
(N)	(40)	(40)	(40)	(40)

E) SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS, TEST OF SPEAKING ABILITY

Groups	Difference	σ_{D_M}	CR	Probability
3 - 1	0.962	.395	2.435	$< .02$
3 - 4	0.325	.373	<1.000	$> .30$
2 - 1	0.750	.386	1.943	$< .06$
4 - 1	0.637	.423	1.506	.12
3 - 2	0.212	.330	<1.000	$> .30$
Electronic Aids- No Electronic Aids	0.212	.384	<1.000	$> .30$

TABLE 11. RESULTS OF SECOND SEMESTER LISTENING COMPREHENSION TEST, FIFTH GRADE, BY DIFFERENT TREATMENT GROUPS, AND BY TEACHER PREPARATION AND EXPERIENCE

A) COVARIANCE ANALYSIS

Source of Variation	Residual				
	Degrees of Freedom	Sum of Squares	Mean Square	F-Ratio	Probability
Research Group	3	1.203	0.401	< 1.000	$> .30$
Teacher Preparation and Experiende	2	173.159	86.580	10.722	$< .001$
Interaction	6	122.723	20.454	2.533	$< .05$
Within Groups	1266	10,222.386	8.075		

B) ADJUSTED MEANS ON LISTENING COMPREHENSION TEST, BY TREATMENT GROUP, AND BY TEACHER PREPARATION AND EXPERIENCE

Teacher Preparation and Experience	Group 1	2	3	4	Total
High	37.751	36.390	36.973	37.236	37.091
Middle	36.610	37.625	37.073	37.559	37.243
Low	36.024	35.730	37.023	35.748	36.166
Total	37.080	36.847	37.022	37.155	37.023
(N)	(306)	(335)	(330)	(309)	(1280)

TABLE 12. CORRELATION BETWEEN NUMBER OF TELEVISED LESSONS REPORTED AS VIEWED IN EVENING AND SECOND SEMESTER LISTENING COMPREHENSION TEST SCORE: BY TREATMENT GROUP AND TEACHER PREPARATION AND EXPERIENCE

Teacher Preparation and Experience	Group: Classroom Drill Evening Viewing	Classroom Drill Electronic Aids Evening Viewing
High	.330	.011
Middle	.170	.137
Low	.677	.259
Total	.303	.179

TABLE 13. SECOND SEMESTER FIFTH GRADE LISTENING COMPREHENSION TEST RESULTS, ANALYZED BY PARENT PARTICIPATION AND BY AMOUNT OF SPANISH SPOKEN IN HOME

A) ADJUSTED TEST MEANS, WITH AND WITHOUT JANUARY TEST USED AS CONTROL VARIABLE (REFLECTING ONLY SECOND SEMESTER OR ENTIRE YEAR LEARNING)

Amount Spanish was Spoken in Home Prior to Program	January Test Used As a Control Variable			January Test Not Used As a Control Variable		
	Parent Partici-pation	No Parent Partici-pation	Total	Parent Partici-pation	No Parent Partici-pation	Total
Most of the time	38.275	40.505	39.975	42.629	46.378	45.151
Part of the time	37.962	38.916	38.510	38.828	42.388	40.873
Very little of the time	37.063	36.088	36.554	36.729	36.006	36.352
Never	36.663	36.587	36.624	36.105	35.066	35.573
Total	36.959	37.107	37.038	36.862	37.191	37.038

B) F-RATIOS AND PROBABILITIES

Effect	January Test Used As a Control Variable			January Test Not Used As a Control Variable		
	F-Ratio	DF	Probability	F-Ratio	DF	Probability
Parent Participation v. No Parent Participation	< 1.000	1/1189	> .30	< 1.000	1/1190	> .30
Amount Spanish was Spoken in Home Prior to Program	13.883	3/1189	< .001	75.901	3/1190	< .001
Interaction	3.051	3/1189	< .05	6.794	3/1190	< .001

TABLE 14. EFFECT OF PARENT PARTICIPATION ON SIXTH GRADE PUPILS' LISTENING COMPREHENSION DURING THE SECOND EXPERIMENTAL YEAR

A) COVARIANCE ANALYSES

First Semester Test

Source of Variation	Residaul		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	1,479	43,369.778	
Within Groups	1,478	43,247.376	29.261
Between Groups	1	122.402	122.402

$$F = \frac{122.402}{29.261} = 4.183$$

$$P < .05$$

Second Semester Test --
Second Semester Learning Reflected

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	1,807	52,498.710	
Within Groups	1,806	52,153.929	28.878
Between Groups	1	344.781	344.781

$$F = \frac{344.781}{28.878} = 11.939$$

$$P < .001$$

Second Semester Test --
Full Year Learning Reflected

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	1,808	106,888.869	
Within Groups	1,807	106,623.586	59.006
Between Groups	1	265.283	265.283

$$F = \frac{265.283}{59.006} = 4.496$$

$$P < .05$$

B) ADJUSTED GROUP MEANS

Semester Test	Group No Parent Participation	 Parent Participation
First	32.593	33.446
Second -- Second Semester Learning	30.905	32.252
Second -- Full Year Learning	30.931	32.099
(N)	(1549)	(263)

TABLE 15. RESULTS OF THE SECOND SEMESTER LISTENING COMPREHENSION TEST, SIXTH GRADE, SECOND YEAR: RESEARCH GROUP BY TEACHER PREPARATION AND EXPERIENCE

A) COVARIANCE ANALYSES

Began Reading and Writing The Second Semester

Source of Variation	Residual DF	Residual Sum of Squares	Residual Mean Square
Research Treatment	3	416.100	138.700
Teacher Preparation and Experience	2	454.544	227.272
Interaction	6	670.590	111.765
Within Groups	1182	31,452.857	26.610

	F-Ratio	Probability
Research Treatment	5.212	< .001
Teacher Preparation and Experience	8.541	< .001
Interaction	4.200	< .001

Began Reading and Writing The First Semester

Source of Variation	Residual DF	Residual Sum of Squares	Residual Mean Square
Research Treatment	3	730.114	243.371
Teacher Preparation and Experience	2	126.517	63.259
Interaction	6	330.967	55.161
Within Groups	858	22,356.370	26.056

	F-Ratio	Probability
Research Treatment	9.340	< .001
Teacher Preparation and Experience	2.428	> .05
Interaction	2.117	< .05

B) ADJUSTED MEANS

Teacher Preparation and Experience	Began Reading and Writing The Second Semester					Began Reading and Writing The First Semester				
	Automated		Teacher-Directed			Automated		Teacher-Directed		
	No Aids	Aids	No Aids	Aids	Total	No Aids	Aids	No Aids	Aids	Total
High	30.261	29.987	29.620	30.300	30.049	31.536	30.913	33.461	33.076	31.912
Middle	28.972	26.936	27.723	29.824	28.704	31.706	32.727	34.626	31.508	32.626
Low	28.519	29.408	27.709	30.963	29.076	30.528	29.469	32.191	33.541	31.218
Total	29.484	28.704	28.756	30.228	29.407	31.420	31.126	33.536	32.812	31.967

TABLE 16. ADJUSTED MEAN SCORES ON READING AND WRITING TESTS* AT END OF YEAR: PUPILS WHO STARTED READING AND WRITING FIRST AND PUPILS WHO STARTED SECOND SEMESTER, ARRANGED BY LEARNING METHOD AND IQ

A) RESULTS FOR PUPILS WHO STARTED READING AND WRITING FIRST SEMESTER

		Learning Method		
		Automated Text	Teacher-Directed	Total
IQ	High	14.271	16.005	14.926
	Middle	14.558	13.662	14.198
	Low	14.314	15.487	14.687
	Total	14.413	14.706	14.521
	(N)	(600)	(357)	(957)

B) RESULTS FOR PUPILS WHO START READING AND WRITING SECOND SEMESTER

		Learning Method			
		Automated			
		Text	Machine	Teacher-Directed	Total
IQ	High	20.786	21.901	19.695	20.433
	Middle	15.708	18.391	16.128	16.024
	Low	15.360	15.860	13.848	14.799
	Total	16.506	18.949	16.088	16.471
	(N)	(592)	(50)	(380)	(1022)

TABLE 17. FIRST SEMESTER READING AND WRITING SCORES OF PUPILS WHO STUDIED BY PROGRAMMED INSTRUCTION, ARRANGED BY LISTENING COMPREHENSION PRE-TEST SCORES

Listening Comprehension Pre-Test Score	Percent of Pupils	Mean Score on Reading and Writing
25 or less	17.7%	4.061
26 - 30	18.5	6.277
31 - 35	22.2	11.871
36 - 40	23.5	19.421
41 - 45	15.1	26.587
46 - 50	3.0	29.560
	100.0%	

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* Pupils who started reading and writing the first semester took the test covering two semester's work; those who started the second semester took the test covering one semester's work.

TABLE 18. RESULTS OF FIRST SEMESTER READING AND WRITING TEST, SECOND YEAR, BY EXPERIMENTAL GROUP

A) ADJUSTED TEST MEANS, STANDARD DEVIATIONS, AND VARIANCES FOR EACH EXPERIMENTAL GROUP

	Group					
	6	8	10	5	7	9
Reading and Writing Test	17.001	15.725	17.665	18.020	16.132	22.167
σ	14.077	12.048	14.097	12.492	12.328	17.077
σ^2	198.167	145.167	198.745	156.071	151.985	291.646
(N)	(93)	(169)	(193)	(277)	(171)	(222)

B) COVARIANCE ANALYSIS

Source of Variation	Residaul		
	DF	Sums of Squares	Mean Square
Total	1120	82,139.767	
Within Groups	1115	76,605.807	68.705
Between Groups	5	5,553.960	1,106.792

$$F = \frac{1,106.792}{68.705} = 16.109$$

$n_1 = 5$ $n_2 = 1115$

$P < .001$

C) SIGNIFICANCE OF DIFFERENCES BETWEEN COMBINED GROUP MEANS

Groups	Difference	σ_{D_M}	CR	P
Automated$_1$ - Automated$_A$	1.834	0.949	1.933	< .06
Teacher-Directed — Automated	3.189	0.918	3.474	< .001
Electronic Aids - No Electronic Aids	2.101	0.869	2.418	< .02

TABLE 19. ADJUSTED MEAN SCORES ON SECOND SEMESTER READING AND WRITING TEST, FOR PUPILS WHO STARTED READING AND WRITING THE FIRST SEMESTER AND THOSE WHO STARTED SECOND SEMESTER, ARRANGED BY LEARNING METHOD AND PREPARATION AND EXPERIENCE OF TEACHERS

A) PUPILS WHO STARTED READING AND WRITING FIRST SEMESTER

		Learning Method		
		Automated Text	Teacher-Directed	Total
Teacher Preparation and Experience	High	15.174	16.598	15.753
	Middle	14.882	15.146	14.997
	Low	14.758	12.609	13.672
	Total	15.081	15.741	15.361
	(N)	(410)	(302)	(712)

B) PUPILS WHO STARTED READING AND WRITING SECOND SEMESTER

		Learning Method			
		Automated			
		Text	Machine	Teacher-Directed	Total
Teacher Preparation and Experience	High	18.348	16.681	16.526	17.619
	Middle	15.227	19.288	13.994	14.993
	Low	12.763	20.036	17.112	14.812
	Total	16.414	18.439 9	15.447	16.165
	(N)	(584)	(42)	(345)	(971)

TABLE 20. RESULTS OF FIRST SEMESTER LISTENING COMPREHENSION TEST, SIXTH GRADE, SECOND YEAR, BY EXPERIMENTAL GROUPS

A) COVARIANCE ANALYSIS

Source of Variation	Residual		
	DF	Sums of Squares	Mean Square
Total	1711	50,654.606	
Within Groups	1706	49,743.830	29.158
Between Groups	5	910.776	182.155

$$F = \frac{182.155}{29.158} = 6.247$$

$n_1 = 5$ $n_2 = 1706$

$P < .001$

B) UNADJUSTED GROUP MEANS

Variable	Group						
	12,14,16	6,8	10	11,13,15	5,7	9	Total
Test	31.490	33.003	34.660	32.147	31.513	35.637	32.938
PM	6.122	6.277	6.593	6.184	6.720	7.372	6.524
GPA	2.545	2.587	2.791	2.603	2.580	2.869	2.654
IQ	101.017	102.527	103.761	100.433	103.117	107.496	102.889
PRE	32.437	34.550	35.563	32.950	33.010	34.894	33.800
(N)	(300)	(300)	(238)	(300)	(300)	(284)	(1722)

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C) ADJUSTED GROUP MEANS, STANDARD DEVIATIONS, AND VARIANCES

	Group					
	12,14,16	6,8	10	11,13,15	5,7	9
Test	32.532	32.522	33.177	32.911	32.157	34.458
σ	8.612	8.311	8.109	8.615	8.299	7.450
σ^2	74.167	69.073	65.756	74.218	68.873	55.503

D) SIGNIFICANCE OF DIFFERENCES BETWEEN GROUP MEANS

Groups	Difference	σ_{D_M}	CR	P
10 - 12,14,16	0.645	.723	< 1.000	> .30
10 - 6,8	0.655	.711	< 1.000	> .30
9 - 11,13,15	1.547	.650	2.380	< .02
9 - 5,7	2.301	.652	3.529	< .001
11,13,15 - 12,14,16	0.379	.703	< 1.000	> .30
6,8 - 5,7	0.365	.691	< 1.000	> .30
9 - 10	1.281	.686	1.867	.06
Electronic - No Electronic	0.442	.406	1.089	> .25
Reading and Writing Drill - No Drill	0.300	.429	< 1.000	> .30

TABLE 21. RESULTS OF FIRST SEMESTER SPEAKING TEST, SIXTH GRADE, BY RESEARCH GROUP

A) MEANS, STANDARD DEVIATIONS, AND VARIANCES

	Group					
	12,14,16	6,8	10	11,13,15	5,7	9
Test	13.325	13.188	16.628	14.288	13.200	15.615
σ	3.458	5.133	3.905	6.243	3.945	3.715
σ^2	11.958	26.348	15.249	38.975	15.563	13.801
(N)	(40)	(40)	(39)	(40)	(40)	(39)

B) SIGNIFICANCE OF GROUP DIFFERENCES

Groups	Difference	σ_{D_M}	CR	P
10 - 12,14,16	3.303	.831	3.975	< .001
10 - 6,8	3.440	1.024	3.359	< .001
12,14,16 - 6,8	0.137	.979	< 1.000	> .30
9 - 11,13,15	1.327	1.152	1.153	> .10
9 - 5,7	2.415	.862	2.802	< .01
11,13,15 - 5,7	1.088	1.168	< 1.000	> .30
No Electronic Aids - Electronic Aids	0.004	.609	< 1.000	> .30
Reading Drill - No Reading Drill	0.833	.669	1.245	> .10
Teacher-Directed - No Reading Drill	2.316	.722	3.208	< .01
Teacher-Directed - Automated	2.928	.680	4.306	< .001
Phonics (automated) - No Phonics	1.731	1.035	1.672	< .05*

*One-tailed test

TABLE 22. FIRST SEMESTER LISTENING COMPREHENSION TEST RESULTS, SIXTH GRADE, ANALYZED BY TEACHER PREPARATION AND EXPERIENCE AND BY USE OR NON-USE OF ELECTRONIC AIDS

A) TESTS OF DIFFERENCES AND INTERACTIONS

Secondary Variable		Test Means	Frequency Ratio	Probability
IQ	High	33.635	1.789	> .10
	Middle	32.679		
	Low	32.933		
Interaction			< 1.000	> .10
Sex	Male	32.829	< 1.000	> .10
	Female	33.055		
Interaction			< 1.000	> .10

B) ADJUSTED TEST MEANS

Teacher Preparation and Experience	Group		
	No Electronic Aids	Electronic Aids	Total
High	33.227	32.922	33.103
Middle	30.651	30.253	30.496
Low	31.771	30.286	31.262
Total	32.035	31.612	31.869

F. TABLES ON THE THIRD YEAR'S RESEARCH

To simplify the tables, the experimental groups are identified as follows:

Group Number	Group Treatment = Television Lesson plus:
Fifth Grade	
1	Teacher-directed classroom drill, without electronic aids
2	Classroom drill, plus electronic aids without feedback
3	Classroom drill, plus electronic aids with feedback
Sixth Grade	
4	Programmed instruction in school
5	Programmed instruction in school, revised form
6	Extended reading in school and programmed instruction at home
7	Extended reading in school and programmed instruction, revised form, at home
8	Teacher-directed instruction
9	Teacher-directed and programmed instruction in school
10	Teacher-directed instruction in school and programmed instruction at home
11	Teacher-directed and programmed instruction in school, and extended reading at home
12	Teacher-directed and programmed instruction in school, and Spanish corner
13	Teacher-directed instruction and Spanish corner in school, programmed instruction at home

TABLE 23. RESULTS OF FIFTH GRADE SECOND SEMESTER LISTENING COMPREHENSION TEST, WITH AND WITHOUT THE FIRST SEMESTER TEST USED AS A CONTROL VARIABLE

A) COVARIANCE ANALYSIS

With the First Semester Test

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	875	21,294.872	
Within Groups	873	21,205.866	24.291
Between Groups	2	89.006	44.503

$$F = \frac{44.503}{24.291} = 1.832$$

$P > .05$

Without the First Semester Test

Source of Variation	Residaul		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	876	37,744.560	
Within Groups	874	37,684.533	43.117
Between Groups	2	60.027	30.013

$$F = \frac{30.013}{43.117} = 0.696$$

$P > .20$

B) UNADJUSTED GROUP MEANS AND CONTROL VARIABLES

Variable	EXPERIMENTAL GROUP			
	1	2	3	Total
Second Semester Test	35.827	36.279	36.367	36.141
First Semester Test	36.347	36.914	36.173	36.472
Pre-test	8.923	8.664	8.601	8.739
PM	5.528	5.780	5.596	5.630
GPA	2.603	2.711	2.607	2.639
IQ	103.043	105.675	103.831	104.128

C) ADJUSTED GROUP MEANS

Semester Test	Experimental Group			
	1	2	3	Total
First	36.467	36.590	36.359	36.472
Second -- second semester's learning reflected	35.975	35.856	36.620	36.141
Second -- full year's learning reflected	35.988	35.927	36.532	36.141
(N)	(323)	(280)	(278)	(881)

TABLE 24. FIFTH GRADE LISTENING COMPREHENSION RESULTS ANALYZED BY EXPERIMENTAL TREATMENT AND TEACHER PREPARATION AND EXPERIENCE (TEP)

A) ANALYSIS OF COVARIANCE

First Semester Test

Source of Variation	Residual				
	Degrees of Freedom	Sum of Squares	Mean Square	F-Ratio	Probability
TEP	2	60.391	30.196	.622	> .20
Interaction	4	141.123	35.281	.726	> .20
Within Groups	903	43,836.972	48.546		

Second Semester Test

Source of Variation	Residual				
	Degrees of Freedom	Sum of Squares	Mean Square	F-Ratio	Probability
TEP	2	99.169	49.584	1.969	> .05
Interaction	4	152.399	38.099	1.513	> .05
Within Groups	902	22,707.087	25.174		

B) ADJUSTED GROUP MEANS

	Teacher Experience and Preparation								
	First Semester Test			Second Semester Test -- First Semester as Control			Second Semester Test -- No First Semester Control		
	Low	Middle	High	Low	Middle	High	Low	Middle	High
1	35.736	36.279	35.911	36.262	36.490	35.851	35.851	36.465	35.851
2	36.135	37.132	35.510	35.481	35.716	35.998	35.353	36.297	35.425
3	36.106	36.668	37.131	35.099	35.136	36.922	34.951	35.388	37.503
Total	35.978	36.651	36.205	35.659	35.861	36.365	35.420	36.101	36.288

TABLE 25. SECOND SEMESTER LISTENING COMPREHENSION TEST RESULTS, FIFTH GRADE, ANALYZED BY PRIOR SPANISH IN HOME, CLASS SIZE, AND USE OF REGULAR OR OTHER TEACHER

A) TESTS OF DIFFERENCES AND INTERACTIONS FOUND IN COVARIANCE ANALYSIS

Secondary Variable	Category	Test Mean	F-Ratio	DF	Probability
Sex	Male	36.824	< 1.000	1/878	> .20
	Female	35.272			
Interaction			2.006	2/878	> .05
Prior Spanish in Home	Most of the time	39.433	6.084	3/865	< .001
	Part of the time	36.576			
	Very little of the time	35.633			
	None of the time	35.880			
Interaction			4.958	6/865	< .001
Class Size	33 or fewer pupils	36.003	< 1.000	1/806	> .20
	34 or more pupils	36.439			
Interaction			2.048	2/806	> .05
Regular or Other teacher	Has pupils all day	35.653	2.145	2/902	> .05
	Has pupils part of day	36.433			
	Teaches Spanish Only	36.244			
Interaction			1.920	4/902	> .05

B) ADJUSTED MEANS, PRIOR SPANISH SPOKEN IN HOME, RELATED TO EXPERIMENTAL TREATMENT

Spanish Spoken in Home Prior to Beginning Program	Experimental Group		
	1	2	3
Most of the time	41.678	37.655	37.026
Part of the time	36.604	35.777	37.808
Very little of the time	34.253	37.557	35.051
None of the time	35.693	34.751	37.171

TABLE 26. RESULTS OF FIFTH GRADE SECOND SEMESTER SPEAKING TEST

A) COVARIANCE ANALYSIS

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	171	1,446.927	
Within Groups	169	1,436.774	8.502
Between Groups	2	10.153	5.077

$$F = \frac{5.077}{8.502} = 0.597$$

$P > .20$

B) ADJUSTED GROUP MEANS

Semester Test	Experimental Group			
	1	2	3	Total
First	7.826	7.603	7.187	7.577
Second -- Second Semester's Learning Reflected	16.167	16.559	16.967	16.511
Second -- Full Year's Learning Reflected	16.357	16.629	16.609	16.511
(N)	(71)	(55)	(49)	(175)

C) ADJUSTED GROUP MEANS, EXPERIMENTAL GROUPS RELATED TO TEACHER PREPARATION AND EXPERIENCE

Teacher Experience and Preparation	Experimental Group			
	1	2	3	Total
High	17.678	16.604	17.283	17.213
Middle	15.372	15.875	16.551	15.791

D) ADJUSTED GROUP MEANS, EXPERIMENTAL GROUPS RELATED TO PRIOR SPANISH SPOKEN IN HOME

Spanish Spoken in Home Prior to Beginning Program	Experimental Group		
	1	2	3
Most or Part of the time	19.673	17.145	16.328
Very little of the time	15.522	16.605	15.729
None of the time	16.241	16.547	17.345

TABLE 27. FIFTH GRADE LISTENING COMPREHENSION RESULTS ANALYZED BY PARENT PARTICIPATION AND PRIOR SPANISH SPOKEN IN HOME

A) COVARIANCE ANALYSIS

First Semester Test

Source of Variation	Residual			F-Ratio	Probability
	Degrees of Freedom	Sum of Squares	Mean Square		
Parent Participation	1	98.982	98.982	2.635	> .05
Prior Spanish in Home	3	2,253.617	751.206	20.000	< .001
Interaction	3	264.564	88.188	2.347	> .05
Within Groups	808	30,349.201	37.561		

Second Semester Test

Source of Variation	Residual			F-Ratio	Probability
	Degrees of Freedom	Sum of Squares	Mean Square		
Parent Participation	1	77.067	77.067	1.902	> .05
Prior Spanish in Home	3	1,940.100	646.700	15.064	< .001
Interaction	3	336.349	112.116	2.768	< .05
Within Groups	808	32,736.301	40.510		

B) ADJUSTED GROUP MEANS

Spanish Spoken in Home Prior to Beginning Program	Test					
	First Semester		Second Semester -- Semester Reflected		Second Semester -- Full Year Reflected	
	Parent Help	No Parent Help	Parent Help	No Parent Help	Parent Help	No Parent Help
Most of the time	42.462	41.893	36.486	38.099	40.571	41.811
Part of the time	36.474	38.667	36.705	36.385	36.865	37.981
Very little of the time	36.798	36.365	35.857	36.015	36.229	36.105
None of the time	36.004	34.446	36.074	35.351	35.926	34.081

TABLE 28. RESULTS OF SECOND SEMESTER FIFTH GRADE LISTENING COMPREHENSION TEST ANALYZED BY PARENT PARTICIPATION AND OCCUPATION OF HEAD OF HOUSEHOLD

A) COVARIANCE ANALYSIS

Source of Variation	Residual			F-Ratio	Probability
	Degrees of Freedom	Sum of Squares	Mean Square		
Parent Participation	1	198.313	198.313	4.937	< .05
Occupation	2	11.317	5.659	0.141	> .20
Interaction	2	12.258	6.129	0.153	> .20
Within Groups	583	23,420.228	40.172		

B) ADJUSTED GROUP MEANS

Occupational Level	Parent Participation		
	Parent Help	No Parent Help	Total
High	36.364	34.452	35.394
Middle	35.871	35.053	35.441
Low	35.906	34.799	35.235
Total	35.996	34.863	35.384

TABLE 29. RESULTS OF THE SIXTH GRADE SECOND SEMESTER LISTENING COMPREHENSION TEST ANALYZED BY EXPERIMENTAL TREATMENT

A) COVARIANCE ANALYSIS

With the First Semester Test

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	1,848	51,990.781	
Within Groups	1,839	51,175.995	27.828
Between Groups	9	814.786	90.532

$$F = \frac{90.532}{27.828} = 3.253$$

$P < .001$

Without the First Semester Test

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	1,849	69,324.729	
Within Groups	1,840	68.079.610	37.000
Between Groups	9	1,245.119	138.347

$$F = \frac{138.347}{37.000} = 3.739$$

$P < .001$

B) ADJUSTED MEANS

Experimental Group	Test Mean		(N)
	Second Semester's Learning Reflected	Full Year's Learning Reflected	
4	31.873	31.168	(164)
5	32.281	32.312	(179)
6	33.050	33.086	(112)
7	31.967	31.929	(117)
8	32.618	32.978	(222)
9	32.952	33.066	(201)
10	32.033	32.309	(230)
11	31.508	31.022	(174)
12	33.769	33.735	(242)
13	32.235	32.407	(213)

TABLE 30. RESULTS OF SIXTH GRADE SECOND SEMESTER LISTENING COMPREHENSION TEST ANALYZED BY EXPERIMENATL TREATMENT AND TEACHER EXPERIENCE AND PREPARATION

A) COVARIANCE ANALYSIS

Source of Variation	Residual			F-Ratio	Probability
	Degrees of Freedom	Sum of Squares	Mean Square		
TEP	1	43.358	43.358	1.253	> .20
Interaction	9	1,775.604	197.289	5.449	< .001
Within Groups	1,830	66,258.648	36.207		

B) ADJUSTED GROUP MEANS

Experimental Treatment	Teacher Experience and Preparation	
	Low	High
4	30.699	31.885
5	32.434	32.157
6	32.489	36.201
7	30.561	36.721
8	32.931	33.092
9	33.563	31.965
10	32.016	33.086
11	31.168	30.708
12	32.979	35.268
13	33.451	30.834
Total	32.351	32.722

TABLE 31. RESULTS OF THE SIXTH GRADE SECOND SEMESTER LISTENING COMPREHENSION TEST ANALYZED BY EXPERIMENTAL TREATMENT AND CLASS SIZE

(Covariance analysis revealed an interaction, with an F-ratio of 3.462, which with n_1 of 9 and n_2 of 1,757 is significant beyond the .001 level)

A) ADJUSTED GROUP MEANS

Experimental Treatment	Class Size	
	29 or fewer	30 or more
4	29.731	32.602
5	30.722	32.282
6	34.921	32.441
7	31.137	32.269
8	33.667	32.803
9	33.941	33.175
10	33.413	31.938
11	30.082	31.582
12	35.085	33.205
13	33.040	31.987
Total	32.472	32.454

TABLE 32. RESULTS OF THE SIXTH GRADE SECOND SEMESTER READING AND WRITING TEST ANALYZED BY EXPERIMENTAL TREATMENT

A) COVARIANCE ANALYSIS

With the First Semester Test

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	1,848	79,600.470	
Within Groups	1,839	78,230.491	42.540
Between Groups	9	1,369.979	152.220

$$F = \frac{152.220}{42.540} = 3.578$$

$P < .001$

Without the First Semester Test

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	1,849	131,295.900	
Within Groups	1,840	126.666.912	68.841
Between Groups	9	4,628.988	514.332

$$F = \frac{514.332}{68.841} = 7.471$$

$P < .001$

B) ADJUSTED GROUP MEANS

Experimental Group	Test Mean		(N)
	Second Semester's Learning Reflected	Full Year's Learning Reflected	
4	15.924	13.970	(164)
5	16.885	16.166	(179)
6	16.907	16.785	(112)
7	15.569	15.188	(117)
8	17.346	17.474	(222)
9	18.778	20.017	(201)
10	17.254	17.711	(230)
11	17.710	17.367	(174)
12	17.622	18.608	(242)
13	18.313	18.056	(213)

TABLE 33. RESULTS OF SECOND SEMESTER SIXTH GRADE READING AND WRITING TEST ANALYZED BY EXPERIMENTAL TREATMENT AND TEACHER PREPARATION AND EXPERIENCE

A) COVARIANCE ANALYSIS

Source of Variation	Residual			F-Ratio	Probability
	Degrees of Freedom	Sum of Squares	Mean Square		
TEP	1	1,038.749	1,038.749	15.555	< .001
Interaction	9	3,424.632	380.515	5.698	< .001
Within Groups	1,830	122,203.531	66.778		

B) ADJUSTED GROUP MEANS

Experimental Treatment	Teacher Experience and Preparation	
	Low	High
4	14.142	13.711
5	16.068	16.296
6	15.303	24.535
7	13.419	21.378
8	17.245	18.048
9	20.793	18.277
10	17.594	18.018
11	16.623	18.979
12	17.013	21.840
13	17.377	19.079
Total	16.848	18.449

TABLE 34. RESULTS OF SIXTH GRADE SECOND SEMESTER READING AND WRITING TEST ANALYZED BY EXPERIMENTAL GROUP AND CLASS SIZE

A) COVARIANCE ANALYSIS

Source of Variation	Residual			F-Ratio	Probability
	Degrees of Freedom	Sum of Squares	Mean Square		
Class Size	1	318.691	318.691	4.642	< .05
Interaction	9	2,648.756	294.306	4.287	< .001
Within Groups	1,757	120,612.319	68.674		

B) ADJUSTED GROUP MEANS

Experimental Treatment	Class Size	
	29 or fewer	30 or more
4	13.388	15.340
5	15.125	16.276
6	22.167	14.767
7	14.504	15.948
8	19.091	16.986
9	20.389	19.952
10	18.933	17.270
11	16.389	18.112
12	21.690	17.374
13	18.692	17.595
Total	17.871	16.967

TABLE 35. RESULTS OF SIXTH GRADE SECOND SEMESTER SPEAKING TEST, ANALYZED BY EXPERIMENTAL TREATMENT

A) COVARIANCE ANALYSIS

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	214	5,893.861	
Within Groups	209	5,333.580	25.520
Between Groups	5	560.281	112.056

$$F = \frac{112.056}{25.520} = 4.391$$

$P < .001$

B) ADJUSTED GROUP MEANS

Experimental Treatment	Test Mean
5	21.290
8	22.825
9	20.510
12	20.226
13	24.787
Total	21.688

TABLE 36. RESULTS OF THE SIXTH GRADE LISTENING COMPREHENSION TESTS, PARENT PARTICIPATION VERSUS NO PARENT PARTICIPATION

A) COVARIANCE ANALYSIS

First Semester Test			
Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	1,874	68,251.012	
Within Groups	1,873	68,060.093	36.337
Between Groups	1	190.919	190.919

$$F = \frac{190.919}{36.337} = 5.254$$

$p < .05$

Second Semester Test			
Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	1,873	52,843.630	
Within Groups	1,872	52,623.202	28.111
Between Groups	1	220.328	220.328

$$F = \frac{220.328}{28.111} = 7.838$$

$p < .01$

B) ADJUSTED MEANS

Test	Means	
	No Parent Participation	Parent Participation
First Semester	31.879	32.572
Second Semester	32.257	33.011

TABLE 37. RESULTS OF THE SIXTH GRADE SPEAKING TESTS, PARENT PARTICIPATION VERSUS NO PARENT PARTICIPATION

(None of the F-ratios were above 1.000)

A) ADJUSTED GROUP MEANS

Semester Test	Means	
	No Parent Participation	Parent Participation
First	15.722	15.874
Second -- Second Semester's Learning Reflected	22.278	22.027
Second -- Full Year's Learning Reflected	22.248	22.126
(N)	(167)	(52)

TABLE 38. RESULTS OF THE SIXTH GRADE READING AND WRITING TESTS, PARENT PARTICIPATION VERSUS NO PARENT PARTICIPATION

(F-ratios were not significant for either semester alone; but when full year's learning was reflected, the F-ratio was 5.428. For n_1 of 1 and n_2 of 1,490, p was less than .05)

A) ADJUSTED GROUP MEANS

Semester Test	Means	
	No Parent Participation	Parent Participation
First	22.180	22.945
Second -- Second Semester's Learning Reflected	17.079	17.636
Second -- Full Year's Learning Reflected	16.967	18.024
(N)	(1,161)	(335)

TABLE 39. RESULTS OF SIXTH GRADE LISTENING COMPREHENSION AND READING AND WRITING TESTS, ANALYZED BY PUPIL AND TEACHER INTEREST SCORES

A) ANALYSES OF COVARIANCE

Listening Comprehension Test

Source of Variation	Residual			F-Ratio	Probability
	Degrees of Freedom	Sum of Squares	Mean Square		
Teacher Interest	2	343.459	171.730	4.694	< .01
Pupil Interest	2	1,044.801	522.401	14.277	< .001
Interaction	4	62.978	15.744	0.430	> .20
Within Groups	1,703	62,308.597	36.588		

Reading and Writing Test

Source of Variation	Residual			F-Ratio	Probability
	Degrees of Freedom	Sum of Squares	Mean Square		
Teacher Interest	2	1,107.863	553.932	5.617	< .01
Pupil Interest	2	4,121.816	2,060.908	20.897	< .001
Interaction	4	202.430	50.608	0.513	> .20
Within Groups	1,703	167,950.138	98.620		

B) ADJUSTED GROUP MEANS

Pupil Interest	Listening Comprehension Test				Reading and Writing Test			
	Teacher Interest				Teacher Interest			
	Low	Middle	High	Total	Low	Middle	High	Total
High	32.969	32.761	33.175	32.946	23.533	22.427	25.627	23.733
Middle	32.213	32.071	33.416	32.509	24.492	23.599	24.708	24.165
Low	30.754	30.360	31.567	30.816	20.904	19.607	21.051	20.376
Total	31.947	31.713	32.795	32.101	23.087	22.032	23.881	22.868

TABLE 40. RELATIONSHIP BETWEEN TEACHER INTEREST AND TEACHER EXPERIENCE AND PREPARATION

Teacher Interest	Teacher Experience and Preparation			Significance Test
	Low	Middle	High	
High	27.59%	23.88%	30.00%	
Middle	51.72	40.30	41.67	$X^2 = 2.734$
Low	20.69	35.82	28.33	$.50 < P < .70$
Total	100.00%	100.00%	100.00%	
(N)	(29)	(67)	(60)	

TABLE 41. RESULTS OF SIXTH GRADE LISTENING COMPREHENSION AND READING AND WRITING TESTS ANALYZED BY TEACHER INTEREST SCORES AND TEACHER EXPERIENCE AND PREPARATION

(Both the independent variables and the interaction produced significant F's. With listening comprehension, the interaction F was 5.954; and with reading and writing, 2.334. The probabilities of these two F-ratios, with n_1 of 4 and n_2 of 1.823, were, respectively, less than .001 and approximately .06)

A) ADJUSTED GROUP MEANS

Teacher Interest	Listening Comprehension Test			Reading and Writing Test		
	TEP			TEP		
	Low	Middle	High	Low	Middle	High
High	31.725	32.243	33.586	21.237	22.398	23.967
Middle	30.610	32.564	31.187	21.390	22.713	21.335
Low	32.922	32.227	31.015	20.841	23.768	22.961

TABLE 42. INFLUENCE OF SEVERAL FACTORS ON PUPIL INTEREST

A) RESULTS OF COVARIANCE ANALYSIS

Effect	F-Ratio	Degrees of Freedom		Probability
		n_1	n_2	
Teacher Interest	0.683	2	1,750	> .20
TEP	1.468	2	1,750	> .05
Parent Participation	1.614	1	1,829	>.05
Experimental Treatment	4.923	9	1,308	< .001
Pupil Pre-interest	162.485	3	1,702	< .001

B) ADJUSTED PUPIL INTEREST MEANS, PUPIL PRE-INTEREST BY TEACHER INTEREST

(interaction not statistically significant)

Pupil Pre-interest	Teacher Interest			
	Low	Middle	High	Total
High	14.013	14.331	14.860	14.415
High Middle	12.651	12.477	12.475	12.524
Low Middle	9.048	9.488	10.025	9.529
Low	6.590	7.829	7.450	7.369
Total	10.941	11.213	11.362	11.186

C) ADJUSTED PUPIL INTEREST MEANS, EXPERIMENTAL GROUP BY TEACHER INTEREST

Experimental Treatment	Teacher Interest			
	Low	Middle	High	Total
4	10.706	10.567	10.908	10.703
5	10.340	9.807	10.761	10.217
8	10.178	9.118	11.904	10.364
9	9.504	10.288	9.078	9.884
10	12.053	12.043	12.187	12.087
11	11.372	13.862	9.875	12.106
12	11.700	12.588	11.353	11.932
13	11.905	11.581	11.344	11.607
6	10.780	11.497	12.129	11.393
7	10.744	12.289	12.837	12.285

TABLE 43. RESULTS OF SECOND SEMESTER SIXTH GRADE LISTENING COMPREHENSION AND READING AND WRITING TESTS, "TOMORROW'S CLASSROOM" (TC) CLASSES COMPARED TO OTHER GROUPS

A) COVARIANCE ANALYSIS

Listening Comprehension Test

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	2,115	80,300.023	
Within Groups	2,114	79,131.003	37.432
Between Groups	1	1,169.015	1,169.015

$$F = \frac{1,169.015}{37.432} = 31.230$$

$P < .001$

Reading and Writing Test

Source of Variation	Residual		
	Degrees of Freedom	Sum of Squares	Mean Square
Total	2,115	156,920.219	
Within Groups	2,114	150,751.932	71.311
Between Groups	1	6,168.287	6,168.287

$$F = \frac{6,168.287}{71,311} = 86.498$$

$P < .001$

B) ADJUSTED GROUP MEANS

Test	Mean	
	TC Group	Experimental Groups Combined
Listening Comprehension	35.952	32.574
Reading and Writing	25.220	17.527

G. TABLES FROM THE PARENT INTERVIEW SURVEY

TABLE 44. MARGINALS FROM SELECTED SURVEY QUESTIONS, ARRANGED BY AMOUNT OF SPANISH SPOKEN IN HOME

A) NUMBER OF WEEKS A PARENT CONTINUED TO VIEW WITH CHILD

Weeks Viewing Continued	Spanish Spoken Little or None of the Time	Spanish Spoken Most or All of the Time
None	6%	17%
1 - 3	10	17
4 - 6	12	10
7 - 9	7	3
10 - 12	7	7
13 - 15	2	0
16 - 18	8	0
19 - 21	2	0
22 - 24	2	0
25 or more	21	23
No response	23	23
	100%	100%
(N)	(165)	(30)

B) INCIDENCE OF PRACTICE WITH CHILD

Parent Practiced With Child	Spanish Spoken Little or None of the Time	Spanish Spoken Most or All of the Time
Never	12%	0%
For a time, but stopped	29	27
Throughout program	58	46
No response	1	27
	100%	100%
(N)	(165)	(30)

C) MINUTES OF PRACTICE PER WEEK, AMONG THOSE STILL PRACTICING AT END OF PROGRAM

Minutes per Week	Spanish Spoken Little or None of the Time	Spanish Spoken Most or All of the Time
0 - 5	45%	27%
6 - 11	18	30
12 - 17	8	10
18 - 23	1	0
24 - 29	2	3
30 or more	0	3
No response	26	27
	100%	100%
(N)	(165)	(30)

D) ENJOYMENT OF PROGRAM BY PARENTS

Participation in Program was	Spanish Spoken Little or None of the Time	Spanish Spoken Most or All of the Time
Enjoyed	61%	69%
A chore	8	7
Both	18	7
No response	13	17
	100%	100%
(N)	(165)	(30)

E) EFFECT OF PARTICIPATION ON FAMILY RELATIONSHIPS

Did Participation Make Family Members Closer?	Spanish Spoken Little or None of the Time	Spanish Spoken Most or All of the Time
Yes	34%	37%
No	63	60
No response	3	3
	100%	100%
(N)	(165)	(30)

TABLE 45. INFLUENCE OF PARENTAL ACTIVITIES ON CHILD'S LEARNING

A) COVARIANCE ANALYSES OF SECOND SEMESTER LISTENING COMPREHENSION TEST, BY SINGLE ACTIVITIES

Independent Variable: Viewing with Child

Source of Variation	DF	Residual Sums of Squares	Residual Mean Square
Total	111	4,087.41	
Within Groups	108	3,635.54	33.66
Between Groups	3	451.87	150.62

$$F = \frac{150.62}{33.66} = 4.47$$

$n_1 = 3 \quad n_2 = 108$

$P < .01$

Independent Variable: Practice with Child

Source of Variation	DF	Residual Sums of Squares	Residual Mean Square
Total	151	5,721.61	
Within Groups	149	5,455.92	36.62
Between Groups	2	265.69	132.85

$$F = \frac{132.85}{36.62} = 3.63$$

$n_1 = 2 \quad n_2 = 149$

$P < .05$

(The other two parent activities, using the handbook and practicing with the record, did not produce significant F's when analyzed as single activities.)

B) RELATED MEANS FOR SINGLE ACTIVITIES

For Viewing

Extent of Viewing	Mean	(N)
Never viewed	38.80	(12)
Viewing stopped First semester	35.47	(66)
Viewing stopped Second semester	39.09	(11)
Viewed throughout Program	39.87	(26)

For Practice

Extent of Practice	Mean	(N)
Never practiced	36.89	(21)
Practiced for a Time, but stopped	35.78	(43)
Practiced throughout program	38.71	(91)

C) MEANS FOR PAIRS OF ACTIVITIES

Pair	Mean	(N)
Viewing and Practice:		
Neither viewed nor practiced	36.0	(40)
Practiced but did not view	36.1	(27)
Viewed but did not practice	35.3	(17)
Both viewed and practiced	39.0	(52)
Viewing and Handbook:		
Neither viewed nor used handbook	36.5	(45)
Used handbook but did not view	32.5	(13)
Viewed but did not use handbook	37.9	(16)
Both viewed and used handbook	38.4	(51)
Viewing and Phonograph Record:		
Neither viewed nor used record	36.7	(41)
Used record but did not view	33.8	(16)
Viewed but did not use record	38.6	(34)
Both viewed and used record	32.8	(23)
Practice and Handbook:		
Neither practiced nor used handbook	35.5	(33)
Used handbook but did not practice	37.7	(25)
Practiced but did not use handbook	38.4	(42)
Both practiced and used handbook	37.6	(47)
Practice and Phonograph Record:		
Neither practiced nor used record	30.4	(38)
Used record but did not practice	38.4	(16)
Practiced but did not use record	38.9	(49)
Both practiced and used record	36.9	(32)
Handbook and Phonograph Record:		
Used neither handbook nor record	36.8	(50)
Used record but not handbook	37.5	(17)
Used handbook but not record	38.4	(35)
Used both handbook and record	37.3	(30)

TABLE 46. RELATIONSHIP OF MOTHER'S EDUCATION AND SPANISH TRAINING TO USE OF ACTIVITIES AND TO CHILD'S PERFORMANCE

A) AMOUNT OF VIEWING AND PRACTICE BY MOTHER

Mother's Education and Training	Percent "High" in Practice (Practiced Throughout Program)	Percent "High" in Viewing (Viewed More Than Twelve Weeks)
No college and no Spanish coursess	44%	30%
Some college but no Spanish courses	30%	31%
One or more Spanish courses but no college	53%	43%
Some college and one or more Spanish courses	80%	76%

B) SECOND SEMESTER LISTENING COMPREHENSION SCORES

Mother's Education and Training	Children's Mean Scores			
	Mother High on Both Viewing and Practice	(N)	Neither Parent High on Both Viewing and Practice	(N)
No college and no Spanish courses	36.3	(12)	35.7	(34)
Some college but no Spanish courses	39.0	(9)	37.3	(15)
One or more Spanish courses but no college	40.0	(6)	36.9	(9)
Some college and one or more Spanish courses	40.1	(16)	39.5	(10)

H. PREVIOUS REPORTS OF THE PROJECT

(to May 1, 1964)

1. A New Opportunity for Parent Participation in Education (April, 1961)
2. A Two-Dimensional Covariance Analysis Program for the Datatron 205 Computer (June, 1961)
3. Measurement of Listening Comprehension via Television in Elementary School Spanish Instruction (October, 1961)
4. Development of Programmed Learning Materials for Use with Televised Spanish Instruction (November, 1961)
5. Results of the First Year's Research in the Denver-Stanford Project (January, 1962)
6. An Attempt to Measure Academic Achievement Efficiency (March, 1962)
7. Reading and Writing Results in the Second Year of Research -- 1961-62 (May, 1963)
8. Audio-Lingual Results in the Second Year of Research -- 1961-62 (June, 1963)
9. Measurement of Speaking skills in Elementary Level Spanish Instruction (July, 1963)
10. Third Year Results in the Denver-Stanford Project (March, 1964)

Reports to come:

11. Research in Retrospect: Administrative Memoranda of the Denver-Stanford Project
12. A Further Search for Elements of Tomorrow's Classroom
13. Causative Factors and Learning Related to Parent Participation

I. ARTICLES ON THE PROJECT

(to May 1, 1964)

Andrade, Manuel, John L. Hayman, Jr., and James T. Johnson, Jr. "Measurement of Listening Comprehension in Elementary School Spanish Instruction." The Elementary School Journal. 45:6 (November 1963), pp. 84-93.

Barcus, Delbert, John L. Hayman, Jr., and James T. Johnson, Jr. "Programming Instruction in Elementary Spanish." Phi Delta Kappan. 44:6 (March 1963), pp. 269-272.

Hayman, John L., Jr., and James T. Johnson, Jr. "Exact vs. Varied Repetition in Educational Television." Audio-Visual Communication Review. 11:4 (July-August 1963), pp. 96-103.

Hayman, John L., Jr. and James T. Johnson, Jr. "Parents Help Educate Their Children Through Instructional Television." The Journal of Experimental Education. 32:2 (Winter 1963), pp. 175-180.

Hayman, John L., Jr., and James T. Johnson, Jr. "Research on the Context of Instructional Television." School Life. 45:6 (April 1963), pp. 8-11.

Hayman, John L., Jr. "Viewer Location and Learning in Instructional Television." Audio-Visual Communication Review. 11:3 (May-June 1963), pp. 27-31.